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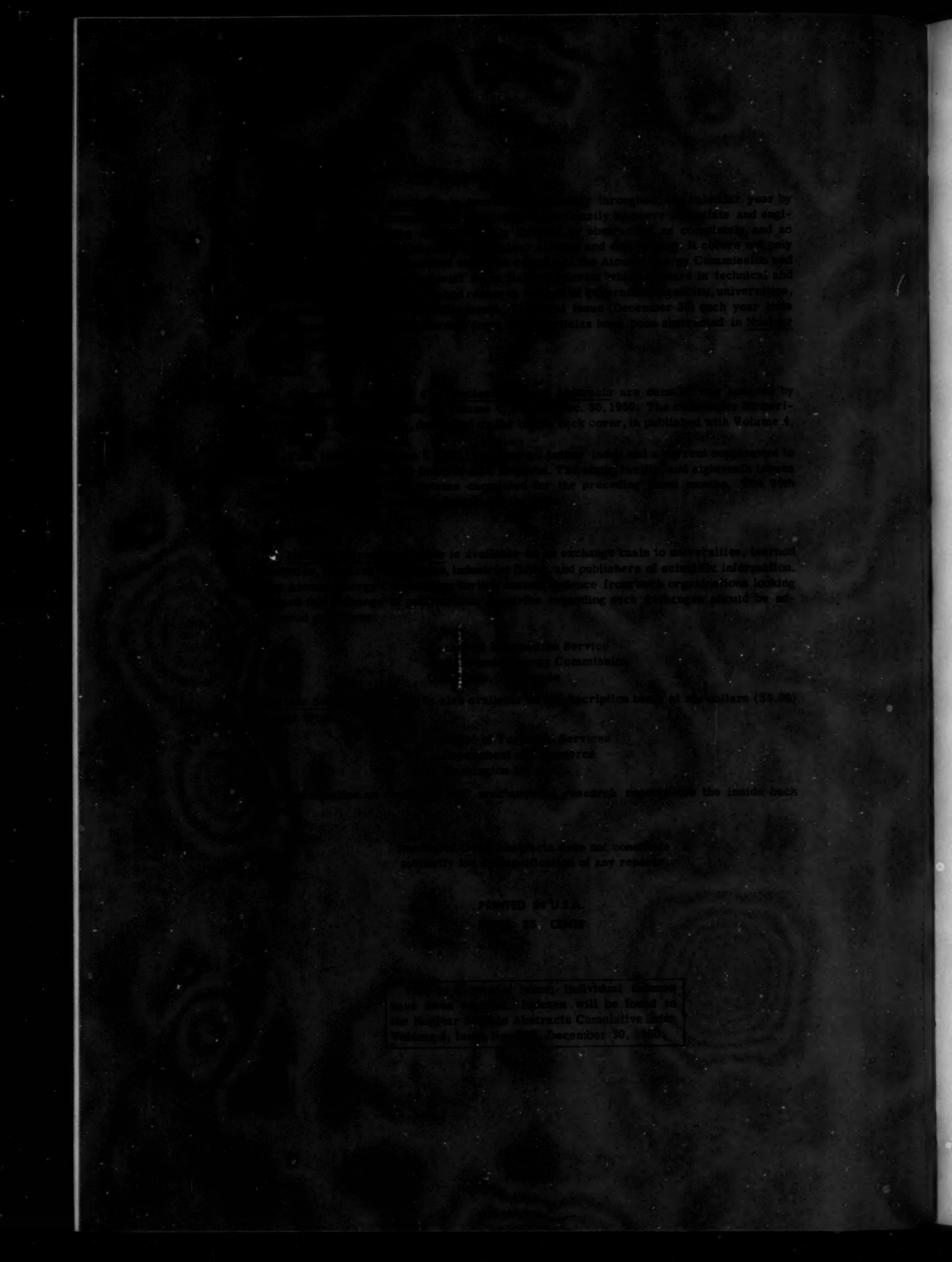

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5555 Observations on the Mechanism of Hemolytic Transfusion Reactions Occurring without Demonstrable Hemolysin. William B. Castle, Thomas Hale Ham, and Shu Chu Shen. AECU-874, nd. 24p.

Studies of a hemolytic transfusion reaction occurring without demonstrable hemolysin and of the experimental hemolytic anemia produced by the injection of concentrations of anti-dog-red-cell-immune serum without lytic power in vitro indicate that in both instances hemolysis is associated with red-cell agglutination and with increase in the osmotic and mechanical fragilities of the red cells. Because hemolysis of red cells by isohemolysins or by comparable concentrations of immune serum in the test tube is not accompanied by increase in the osmotic and mechanical fragilities of the red cells, the possible secondary effects of red-cell agglutination in the animal were studied. It is concluded that red-cell agglutination invokes the sequence of physical and chemical events which may be epitomized as: erythroagglutination, erythrostasis with local exclusion of serum, tissue ischemia, and release of injurious substances from autolyzing tissues adjacent to stagnating red cells. 31 references. (auth)

5556 Studies on the Destruction of Red Blood Cells. VIII. Sickle Cell Disease: Molecular Orientation in Solutions of Sickle Cell Hemoglobin and Its Clinical Significance. John W. Harris and Stephanie J. Bunting. AECU-885, nd. 9p.

It was considered desirable to establish further evidence for molecular orientation or alignment of the abnormal hemoglobin as a basis for the sickling phenomenon. Accordingly, certain observations were made employing stroma-free solutions of hemoglobin in distilled water, prepared by a modification of the method described by Drabkin (J. Biol. Chem. 164, 703(1946)). It is concluded that the alignment and parallel aggregation of the molecules of deoxygenated hemoglobin derived from the red cells of patients with sickel cell disease are manifested as increased viscosity of hemoglobin solutions and the formation of hemoglobin tactoids. These effects take place in solutions at concentrations comparable to those of the intracellular hemoglobin. The increase in voscosity appears to explain the multiple venous thromboses, and the increase in mechanical fragility may largely explain the hemolytic anemia-phenomena which are characteristic of the active disease. Sickling and increases in viscosity and in mechanical fragility of the red cells occur within the range of oxygen saturations of venous blood. 16 references.

5557 Spontaneous Chromosome Fragmentation in Trillium Erectum L. Rhoda C. Sparrow and A. H. Sparrow. AECU-888, nd. 19p.

The frequency of spontaneous chromosome fragmentation has been studied in Trillium erectum. Fragments at first anaphase and microspore metaphase and micronuclei at quartet and microspore interphase were counted and treated statistically. Analysis of micronuclei at microspore interphase in 15 plants showed no significant difference between buds within a plant or anthers within a bud. However, the 15 plants fell into two groups with mean frequencies of 0.666 and 2.908 micronuclei per 100 microspores. There was no overlapping and the difference was statistically significant. It is concluded that "background" counts of spontaneous aberration should be made whenever accurate control values are

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needed in radiation experiments. No significant difference was found between aberration frequency at first anaphase (1.97% fragments), quartet (2.00% micronuclei), and microspore metaphase (2.04 fragments per 100 PMC — microsporocytes, or pollen mother cells) when material was all collected from the same plants. However, microspore interphase had an aberration frequency of 6.00 per 100 PMC or about 3 times that of the other three stages. The reason for the significantly higher frequency at interphase is not understood. The results suggest that the values obtained at any one of three stages (first anaphase, quartet, or microspore metaphase) can be used interchangeably as a control count of spontaneous fragmentation. 23 references. (auth)

5558 Studies on Urinary Histamine in Chronic Myelocytic Leukemia. Morton Lee Pearce and William N. Valentine. UCLA-79, July 21, 1950. 9p.

Since there are increased amounts of histamine in the blood of patients with chronic myelocytic leukemia, the histamine resides mainly in the cells of the granulocytic series beyond the blast stage and the turnover of white blood cells is rapid, an investigation of the fate of this excess histamine was undertaken. Because it has been shown that there are significant amounts of histamine in the urine and that exogenously fed histamine is conjugated and excreted by this route, studies have been made to discover whether the fasting-urine histamine was elevated in patients with chronic myelocytic leukemia. In the cases studied the patients had an average blood histamine of 8.7 μg/ml as compared with a normal average of 0.075 μg/ml, a hundredfold difference. On the other hand, the average fasting excretions of urine histamines were 30.8 μg/hr and 27.0 μg/hr, respectively, in the two groups. Assuming a 24-hr life span for the white blood cell, it can be calculated that in patients with chronic myelocytic leukemia only a small amount of the blood histamine is accounted for by urinary excretion. Some other mechanism for its removal must be postulated. 10 references. (auth)

5559 A Protamine Titration as an Indication of a Clotting Defect in Certain Hemorrhagic States. J. Garrott Allen, Peter V. Moulder, Richard M. Elghammer, Burton J. Grossman, Charles L. McKeen, Margaret Sanderson, Willadene Egner, and James M. Crosbie. J. Lab. Clin. Med. 34, 473-6(1949) Apr.

A method for measuring a clotting defect in certain hemorrhagic states is described. The influence of protamine requirements in certain cases (prothrombin deficiency, heparinization, hemophilia, thrombocytopenia) is discussed.

5560 The Effect of Terramycin on Post-Irradiation Infection in Mice. Carolyn W. Hammond and C. Phillip Miller. AECU-873, nd. 12p.

Cultures of heart's blood and spleen of mice subjected to a single dose of x-radiation showed a high incidence of bacteremia during the second week, the period of greatest mortality. The septicemia was caused by microorganisms normally present in the lower bowel of the stock mice. In a majority of animals, the infection was severe enough to be regarded as an overwhelming sepsis. The administration of terramycin protected irradiated mice against the septicemia occurring the second week post-irradiation, unless it was caused by terramycin-insensitive bacteria. The most common of these was Pseudomonas against which no antibiotic

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or combination of antibiotics tested thus far has been found to be effective. Preliminary experiments suggest that the administration of streptomycin together with terramycin may prove more effective than terramycin alone in controlling infections caused by drug-sensitive organisms. (auth)

5561 Elementary Chemical Processes in Radiobiological Reactions. Milton Burton. AECU-889, nd. 28p.

The elementary chemical processes of radiobiology are the elementary chemical effects of high energy radiation on aqueous solutions containing oxygen, on pure organic matter, and on organic matter suspended in aqueous solution. In the aqueous layer the important primary physical process is ionization; in the organic portion both ionization and excitation must be considered. In biological systems the active particles in the aqueous layer are principally O H and HO_2. The presence of the latter particle increases the volume of the effective aqueous layer around the biological particle. The effectiveness of a hit in the organic material is determined in part by the properties of the surrounding cage and depends, among other factors, on the size of the biological particle. The effect of a hit may be propagated by ionization transfer, by free radical diffusion, by a chain reaction, or by change in local pH. Furthermore, free H and resultant HO_2 are formed in the ambient liquid even when the hit is in the particle itself. In view of these elementary processes, the biological particle cannot be uniformly sensitive to radiation over its entire volume, the target of "target theory" is not to be identified with the biological particle, a single ionization act is not necessarily lethal, nor is the target dimension simply related to the true size of the biological particle. 28 references. (auth)

5562 Effects of X-ray, Neutron, and Chronic Gamma Irradiation on Growth and Yield of Potatoes. A. H. Sparrow and E. Christensen. AECU-898, nd. 1p.

The document is reproduced below in its entirety.

Latin-square plots of Katahdin potatoes were planted following exposure of the tubers to 18.75, 75, 300, 1200, and 4800 r of 200 kvp x-rays. Control pieces were taken from each tuber before irradiation and included in each Latin square. Irradiation was given at a constant rate of about 4800 r per hour. Statistical analysis showed no significant effect on yield following 18.75, 75, and 300 r, but did show a significant adverse effect following 1200 and 4800 r. These yielded, respectively, 75% and 4% of the controls. The latter dosage is shown to be near the lethal limit for Katahdin tubers. True seed was collected from the 18.75, 75, and 300 r groups. Statistical tests of germination showed a significant trend toward better germination in the seed from the 300 r group over the 18.75 and 75 r groups. Further tests are under way. Latin-square plots of the same variety were planted in a field where a centrally located gamma source of approximately 16 c of Co^{60} provided continuous irradiation of 0.26, 1.15, 4.8, 19.5, and 79.7 r per day to give full-season totals of approximately 28, 123, 516, 2086, and 8529 r, respectively. Chronic gamma irradiation over this range of dosages produced no significant relation between dosage and yield. There was no evidence of adverse effects on growth or yield even at the highest dosage. The effects of fast-neutron acute irradiation are also under investigation. Significant data will be reported. (auth)

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5563 The Synergistic Effect of Phosphorus^{32} and Colloidal Gold^{198} on Survival in Male Albino Rats. Hymer L. Friedell and James H. Christie. NYO-1609, June 26, 1950. 19p.

Data are presented which indicate that colloidal Au^{198} and P^{32} administered as $Na_2HP^{32}O_4$ are synergistic in their killing effect on the male albino rat. A discussion of the distribution of P^{32} and colloidal Au^{198} and possible mechanism for the synergism are presented. (auth)

5564 Some Effects of 2537 A on Green Algae and Chloroplast Preparations. A. S. Holt, I. A. Brooks, and W. A. Arnold. ORNL-771, Aug. 3, 1950. 54p.

The effects of 2537 A untraviolet radiation on intact cells of green algae have been studied in the hope of gaining more insight into the nature and properties of the catalysts of photosynthesis sensitive to 2537 A; and, possibly by comparison of the sensitivities of the various processes studied, to gain some information as to the relation between them. The following have been investigated: (1) photosynthesis, (2) endogenous respiration, (3) glucose oxidation, (4) photoreduction, (5) oxygen evolution in the presence of a substitute oxidant, i.e., the "Hill reaction," and (6) dark reduction of CO_2 coupled to the oxhydrogen reaction. A similar study with chloroplast preparations compares the effects of 2537 A on the Hill reaction in chloroplasts with the effects on the same reaction and on photosynthesis in intact cells and compares the effects on the Hill reaction with those on other enzymatic systems in chloroplast preparations. (auth)

5565 The Relationship between Essential Fatty Acid Deficiency and Radiation Damage in the Mouse. Arthur B. Decker and James F. Mead. UCLA-52, Dec. 1, 1949. 64p.

The production of both acute and chronic essential fatty acid deficiency in mice is described, and the importance of the chronic deficiency is discussed. Both chronic and acute essential fatty acid deficiency markedly increase the mortality rate of mice exposed to x-rays. The symptoms of essential fatty acid deficiency and radiation damage are similar in many respects, and each condition apparently aggravates the other. 57 references. (auth)

5566 Methods and Background Values for Beta-Gamma Radioactivity in Some Plants from New Mexico and California. David B. Dunn, Margaret R. Lewis, and Sydney H. Gordon. UCLA-75, June 9, 1950. 23p.

This paper is the first of a series of observations made upon material collected about the first atomic bomb detonation site, in order to obtain some concept of what role the low-level contamination of the soil may play in the metabolic and life cycles of the plants in this area. The uptake of natural and artificially radioactive minerals by plants is exceedingly variable for certain herbs, shrubs, and the few crop plants examined in this study. The methods adopted for processing plant materials and the counting procedures used to obtain reliable counts on background or "normal" control material are complicated. Tentative maximum normal control background values for native grasses, some weeds, and juniper bark have been established. 14 references. (auth)

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5567 The Action of X-Rays on the Membrane of Red Corpuscles. J. Zacek and R. Rosenberg. Compt. rend. soc. biol. 144, 462-4(1950) Mar. (in French).

Blood, drawn by veinous puncture, received an x-ray dose of 24,000 r at 80 kv after which it was hemolyzed and dried, and then examined under an electron microscope. The size and shape of the cell membrane did not change (as compared with nonirradiated cells). However, the ordinary granular surface was replaced in some spots by a fine fibrous protein-like structure. The authors believe this change is due to the chemical decomposition of the lipo-protein following the x-radiation. The lipoids form an interstitial network which diffuse out during hemolysis and washing.

5568 Cotton from Bikini. Chromosome Irregularities Found in Plants Grown from Seed Exposed to Gamma Radiation. Meta S. Brown. J. Heredity 41, 115-21 (1950) May. (See also NSA 1-604.)

Cytological analyses of cotton plants grown from seed exposed to an atomic bomb explosion have been made. Irregularities in chromosome pairing have been found and attributed to changes in chromosome structure.

5569 Cytological and Phenotypical Effects Induced in Maize by X-Rays and the Bikini Test Able Atomic Bomb. L. F. Randolph. J. Cellular Comp. Physiol. 35, Suppl. 1, 103-17(1950) June.

The cytological and phenotypical effects of the Bikini atomic bomb were qualitatively similar to those induced by x-rays. With respect to retardation of plant growth, seedling mottling, partial sterility, and the production of leaf sectors involving morphological abnormalities and chlorophyll deficiencies, most heavily irradiated Bikini sample was comparable to an x-rayed sample that had received 15,000 r units, except that a significantly higher frequency of chlorophyll sectors and dead tissue occurred in the bombed sample. Chromosomal mutations including reciprocal translocations, deletions, and inversions were observed with approximately the same frequency in the plants grown from the bombed and x-rayed seed, and in both lots there were many more translocations than there were other types of chromosomal alterations. (auth)

5570 Effects of Atomic Bomb Radiations and X-Rays on Seeds of Cereals. Luther Smith. J. Heredity 41, 125-30(1950) May.

The biological effects of radiations from an atomic bomb and from known dosages of x-rays on dormant seeds of barley, durum, and common wheats have been determined. The relation of age of barley seeds to susceptibility to radiation effects also has been studied and limited macroscopic observations have been made on plants grown from seeds of oats that had been exposed to atomic-bomb ionizing radiation. (auth)

5571 Immunity Conferred by Hyperglycemia Against Lethal Doses of X-Rays. Jean Loiseleur and Georges Velley. Compt. rend. 231, 182-4(1950) July 10 (in French).

Fifty-four adult rats were given total body lethal doses of x-rays (950 r at 180 kv) for 45 min. Forty-five minutes prior to irradiation, 27 of them were given an intraperitoneal injection of glucose (4 cm^3 containing 2 g glucose per 150 g body weight). All controls died, between a period of 5 and 23 days following irradiation, with the usual symptoms of radiation exposure accompanying death. Among the glucose treated rats, 5 died. All the others showed no ill effects and, in fact, exhibited an average gain of weight of 15.5%. The authors discuss the reason for this high immunity.

5572 The Inactivation by X-Rays of the Virus Responsible for the Sensitivity to CO_2 in Drosophila. Philippe L'Heritier and Nadine Plus. Compt. rend. 231, 192-4(1950) July 10 (in French).

Liquid extract derived from crushed sensitive flies and containing 3000 infecting units per mm^3 were exposed to 0.9A x-rays for periods up to 20 min (0 to 9×10^5 r). This irradiated liquid was then injected into drosophila. The effects of the dosage on the virus-like factor responsible for CO_2 sensitivity is discussed.

5573 Induction of Mutation by High-Energy X-Radiation Produced by a 23-Mev Betatron. Hulda Regehr, T. J. Arnason, and H. E. Johns. Nature 166, 228-9 (1950) Aug. 5 (Letter to the editor).

Male Drosophila melanogaster received a single dose of 2000, 5000, or 7000 r of x-radiation at 100 r/min. All the irradiated X-chromosomes which were tested for mutations were obtained from sperms which functioned in fertilization within 20 days of the treatment. The average percentage mutation per 1000 r high-energy x-rays is 1.70%. The corresponding figure for ordinary x-rays as given in the literature is 2.89%. This would indicate that the high-energy radiations are only 0.59 as efficient as ordinary x-rays for the production of lethal mutations. The reason for the difference in effectiveness is discussed.

5574 Influence of Local X-ray Treatment on the Development of Extremities of the Young Axolotl (Siredon Mexicanum). V. V. Brunst. J. Exptl. Zool. 114, 1-35(1950) June. (See also NSA 4-3280.)

In this paper a detailed description of the effects of x-radiation upon the development of the extremities of the axolotl is given. This paper consists of two parts. The first part describes the effects of irradiation upon the lumbo-sacral region in the axolotl. The second part describes the effects of irradiation in the lumbo-sacral region upon the gradual development of the extremities of axolotls. The purpose of these experiments was to investigate the succession of changes in the irradiated parts of the axolotl body during the process of development and to determine whether it is possible to stimulate development by means of weak irradiation. The effects of the irradiation up to 63 days following irradiation is discussed. 27 references.

5575 Search for an Effect of Oxygen on the Direct X-ray Inactivation of Bacteriophage. H. B. Hewitt. Brit. J. Radiology 23, 416-23(1950) July.

A B coli phage has been irradiated with x-rays in broth which contained sufficient protein to suppress the indirect effect due to ionization in the water. Therefore, inactivation of the phage was due to the direct effect of the radiation on the phage particles, to which Lea's theory (Actions of Radiations on Living Cells, 1946, Cambridge University Press) ought to apply. One phage suspension contained 10 to 15 ml/l of dissolved oxygen, and a second zero. The activity of each

suspension diminished exponentially with increase in the x-ray dose. If the oxygen did increase the sensitivity of the phage at all, it was unlikely to have been by more than 10%. The mean diameter of the phage particle, deduced from the 37% inactivation dose and Lea's theory, was 54 mμ. Other methods have given values of 45 and 75 mμ for the same phage. Broth, without phage, containing the normal amount of dissolved oxygen, was given the maximum dose used previously, and then the phage particles were added immediately after the end of the irradiation. No inactivation was detected. No modification of Lea's theory is necessary as a consequence of this experiment. (auth)

5576 Radiation Safety Primer. F. L. Brannigan and E. J. Kehoe. NYO-1520, June 19, 1950. 25p.

A number of sketches of posters illustrating safety precautions for workers handling radioactive materials are shown in this document.

5577 The Use of the Roentgen Equivalent Physical (REP). Karl Z. Morgan. ORNL-783, Aug. 17, 1950. 8p.

The rep is defined and equations relating it to the roentgen for α, β, and γ radiation are derived.

5578 A Study of the Contamination Potential of Polonium Static Eliminators. Louis B. Silverman and Fred A. Bryan. UCLA-84, Aug. 1, 1950. 15p.

A study of polonium-coated metal strips for the elimination of static electricity as supplied by two manufacturers has been made in respect to α-emitter contamination in air and following normal handling. The results indicate that strips produced by the same company are not identical in their contamination possibilities. It also has been found that without definite handling techniques a real health hazard can exist. The study reveals that polonium-coated static eliminators can be used in industry provided careful health-physics regulations are maintained. (auth)

5579 Ionizing Radiation Materials as Air Pollutants. Abel Wolman. Arch. Ind. Hyg. & Occupational Med. 2, 134-6(1950) Aug.

The problem of stack discharges of radioactive materials from reactors and the accidental contamination of cooling air are discussed. The estimated maximum permissible atmospheric concentration of A^{41}, I^{131}, C^{14}, and Xe^{133} is given.

5580 Radioautographs of Frog Membrane. Russell E. Lux, Paul M. Scott, and John E. Christian. Science 112, 205-6(1950) Aug. 18.

Highly radioactive sections of whole frog skin were prepared by exposing the morphological inner surface of a freshly excised membrane to solutions of labeled NaI^{131} for 4 hr. After a preparation with ethyl alcohol, acetone, xylol, and paraffin, described in the article, the slides were coated in the darkroom by spreading on melted lantern slide emulsion. These investigations revealed that there was no selective avenue of penetration of frog membrane by iodide ion, but that the membrane is penetrated as though it were a sieve. Unusual concentration of iodine at the keratinized layer of cells (upper surface of section) is shown. This was a general finding, and was unexpected, since in every case the opposite membrane surface was the one exposed to the highly radioactive solution. This localization has been tentatively interpreted as indicating that either iodide ion is selectively adsorbed by the keratinized cells, e.g., the constituent proteins of these cells are more easily iodinated than other cells, or that the inert layer of cells acts as a barrier to the passage of iodide ion.

5581 The Direct Measurement of I^{131} Uptake in the Thyroid Gland; Further Observations. A. Stone Freedberg, David L. Chamovitz, Alvin L. Ureles, and Marvin A. VanDilla. J. Clin. Endocrinol. 10, 910-32(1950) Aug.

A new method for the quantitative measurement of thyroid gland uptake of I^{131} consisting of four parallel-connected copper-cathode G-M tubes arranged horizontally in a circle about the patient's neck is described. Observations on patients are given indicating an accuracy of ±5% and a sensitivity allowing the use of 100 to 150 μc as a tracer dose. Measurements on thyroid gland uptake following tracer and therapeutic doses of I^{131} are compared.

5582 The Antagonistic Effect of Cysteine on Nitrogen Mustard. Austin S. Weisberger, Robert W. Heinle, and James H. Christie. NYO-1611, July 31, 1950. 12p.

Cysteine is known to reduce the mortality in rats when it is injected prior to the exposure of the rats to lethal doses of irradiation. The effect of cysteine on the similar hematologic reactions following nitrogen mustard exposure has been investigated. Intraperitoneal administration of cysteine solution to rabbits and rats prior to injection of nitrogen mustard protects against leukopenia and strikingly reduces the mortality rate. The characteristic marked rise in neutrophils is not affected. Administration of cysteine within 5 min after injection of nitrogen mustard results in no protection. The problem of the mechanism of the protective action of cysteine is discussed but no conclusions are reached.

5583 The Skeletal Deposition of Nonradioactive Strontium. N. S. MacDonald, R. E. Nusbaum, Florita Ezmirlian, R. Stearns, Clarè McArthur, and Patricia Spain. UCLA-80, July 7, 1950. 21p.

The chronic effects of strontium lactate in the drinking water of growing mice are described. Although of low toxicity, Sr actively inhibits calcification and causes stunting. Analysis of Ca:Sr ratios of the femur ash indicates the operation of two distinct modes of Sr deposition in the bone and these are described. A spectrographic method for quantitative simultaneous determination of Ca and Sr in bone ash is given.

5584 Inhibition of the Uptake of Radioactive Phosphate by Human Erythrocytes in Vitro. D. R. H. Gourley. AECU-872, nd. 26p.

It is demonstrated that the rate at which P^{32} is taken up by human erythrocytes in vitro is depressed by the addition of iodoacetic acid (IAA) or sodium fluoride. A maximum inhibition (to about 20 to 25% of the normal rate) is observed in the presence of 5.0×10^{-4}M IAA or 2.0×10^{-3}M NaF. The inhibitory action of IAA is not reversible and is exerted almost entirely upon the P^{32} uptake of the erythrocytes rather than the white cells and platelets. The presence of higher concentrations of NaF brings about what appears to be a two-

phase uptake of P^{32}. The initial phase is a process of rapid diffusion, the rate of which is not affected by a drop in temperature from 37 to 15°C, while the later phase is similar to the depressed chemical mechanism observed in the presence of IAA. A combination of IAA and NaF inhibits the P^{32} uptake to a greater degree than the maximum observed with either of the two alone, but does not cause complete inhibition. According to Wilbrandt's data (Pflüger's Arch. ges. Physiol. 243, 519(1940)) the glycolytic system of the erythrocytes is completely inhibited by the concentrations of these substances which have a maximal effect on P^{32} uptake. It is inferred that enzymatic reactions other than the phosphorylating reactions of glycolysis are involved in phosphate transfer in erythrocytes. Sodium azide, 2,4-dinitrophenol, cysteine, and mercuric chloride are without effect on P^{32} uptake. (auth)

5585 The Blood and Packed Cell Volume of the Adult Rat as Measured by Tagged Cells. L. M. Sharpe, George G. Culbreth, and J. Raymond Klein. AECU-886, nd. 14p.

The mean blood and packed cell volumes of 22 adult male rats, as measured by transfused tagged cells using $Fe^{55,59}$, was found to be 4.95 and 2.32 ml/100 g of body weight, respectively. The mean blood and packed cell volumes of 6 of the 22 rats, assayed by the hemoglobin extraction method, were found to be 4.92 and 2.32 ml/100 g of body weight. The efficiency of perfusion for the total rat was 95%. This corresponds to a possible error in blood volume, introduced by removal of tagged transfused cells from the recipients circulation, no greater than 5%. Comparison of the blood volume of various tissues taken from maximally bled rats with the blood volumes of similar tissues taken from perfused rats indicates that perfusion is least effective for spleen and most effective for kidney and brain. (auth)

5586 On the Mechanism of Lactic Acid Synthesis by the Fungus Rhizopus Oryzae Studied with C^{14}. Ruth Gastel and Martin Gibbs. AECU-895, nd. 1p.

The document is reproduced below in its entirety.

Spores of Rhizopus oryzae NRRL 395, a lactic-acid-producing fungus, were germinated on a medium of glucose, $MgSO_4$, KH_2PO_4, $(NH_4)_2SO_4$ and $ZnSO_4$, and $CaCO_3$. After two days, this medium was replaced by glucose-3,4-C^{14} or unlabeled glucose and $Na_2C^{14}O_3$. Fermentations were carried out aerobically and anaerobically until all the glucose was consumed. The lactic acid was isolated and chemically degraded. During the aerobic and anaerobic fermentations with unlabeled glucose and $Na_2C^{14}O_3$, label was fixed exclusively in the carboxyl carbon of the lactic acid. When glucose-3,4-C^{14} was fermented aerobically and anaerobically, the distribution of label in the lactic acid was: carboxyl carbon 97%, alpha carbon 2.2%, beta carbon 0.8%. The specific activity of the lactic acid was the same as the glucose-3,4-C^{14} which would indicate that all the lactic acid was derived from the glucose. These results will be discussed and compared to similar experiments with a homofermentative lactic acid bacterium. (auth)

5587 Distribution of Labeled Carbon in Various Metabolites of Sunflower Leaves After Exposure to $C^{14}O_2$. Martin Gibbs. AECU-900, nd. 1p.

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The document is reproduced below in its entirety.

Sunflower leaves were exposed to $C^{14}O_2$ for 1.5 and 4 min in strong light. After killing in 80% alcohol, sucrose, glucose, fructose, alanine, malic acid, dextrin, and starch were isolated and degraded. The sucrose was hydrolyzed and the two monosaccharides degraded separately. Glucose and fructose did not contain C^{14}. The degrees of labeling in the carbon atoms of glucose and fructose obtained after sucrose hydrolysis were equal. Of the carbohydrates, starch was slowest to approach uniform distribution. Alanine behaved similarly to sucrose, while malic acid showed little relation to the other metabolites. (auth)

5588 Metabolism of Soy Bean Leaves. II. Amino Acids Formed during Short-term Photosynthesis. L. P. Vernon and S. Aronoff. AECU-914, nd. 14p.

The amino acids found to contain radioactivity in 15 and 50-sec photosynthetic periods are, in order of decreasing specific and total activity, alanine, serine, and glycine. Chemical methods for the determination of the distribution of activity within the listed amino acids are reported. Glycine has slightly higher activity in the C_3 position in 15-sec photosynthesis, becoming essentially equal in 50 sec. Both alanine and serine have higher activity in the C_1 position, with the C_2 and C_3 positions being equal. Alanine contains the highest percentage of activity in the C_1 position. Alanine is assumed to be directly connected to the main photosynthetic reaction chain, while both serine and glycine derive their activity by more circuitous routes. Alanine and serine arise from the addition of $C^{14}O_2$ to some two-carbon compound of equal activity distribution. Nothing can be said as to the origin of the two-carbon compounds. (auth)

5589 The Use of Plasma Protein Tagged with $Iodine^{131}$ in the Study of Blood Volumes. John P. Storaasli, Harvey Krieger, Hymer L. Friedell, and William D. Holden. NYO-1608, June 26, 1950. 23p.

A method is presented for determining the plasma volume of human patients by the measurement of the dilution of I^{131}-iodinated albumin after intravenous injection. Results of experimental comparison with blood-volume determinations by the use of azo dye T-1824 and P^{32}-labeled red cells are given. The stability of the iodinated protein and its relatively secure retention within the vascular system permits a more accurate estimate of the plasma volume than has hitherto been possible.

5590 Direct Determinations of Plasma, Cell, and Organ-Blood Volumes in Normal and Hypervolemic Mice. Leon Wish, Jacob Furth, and Robert H. Storey. ORNL-749, July 13, 1950. 19p.

Direct single and combined cell- and plasma-volume determinations have been made with P^{32}-tagged red cells and I^{131}-tagged plasma. The data indicate that the Evans blue (T-1824) volume determinations are too high but useful if a conversion factor is applied. The so-called "mixing time" of Evans blue is really a time of withdrawal by Evans blue-affin cells. Causes of hypervolemia are discussed.

5591 Acetoacetic Acid Formation in Vitro from Odd and Even Numbered Radioactive Fatty Acids. R. P.

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Geyer, Mary Cunningham, and Joyce Pendergast. J. Biol. Chem. 185, 461-8(1950) Aug.

When incubated with liver slices, both odd numbered and even numbered acids ($RC^{14}OOH$) gave rise to asymmetrically labeled acetoacetic acid. The degree of asymmetry was conditioned by the length of the carbon chain of the substrate. Carboxyl- and β-labeled octanoic acids gave rise to acetoacetic acid with the same $C^{14}O:C^{14}OOH$ ratio. α-Labeled octanoic acid gave rise to acetoacetic acid which contained radiocarbon almost exclusively in the acetone moiety. The acetoacetic acid formed by kidney slices had a lower $C^{14}O:C^{14}OOH$ ratio generally than did that formed from these substrates by liver slices. The results are discussed from the standpoint of the influence of the relative number of terminal (CH_3CO-) groups and ($-CH_2CO-$) groups on the symmetry of the acetoacetic acid produced. 11 references. (auth)

5592 The Biogenesis of Porphyrins. 2. The Origin of the Methyne Carbon Atoms. Helen M. Muir and A. Neuberger. Biochem. J. 47, 97-104(1950) June-July. (See also NSA 4-2975, 4-3890, and 4-3896.)

Porphyrin synthesis in rabbits and rats was investigated after administration of sodium acetate, glycine, serine, and formic acid labeled as indicated in the following formulas:

$C^{14}H_3.COONa$ $CH_3.C^{14}OONa$

$NH_2.C^{14}H_2.COOH$ $N^{15}H_2.C^{14}H_2.COOH$

$C^{14}H_2OH.CH(NH_2).COOH$ $H.C^{14}OOH$

The porphyrin was degraded by oxidation to carbon dioxide, methylethylmaleic acid imide and hematinic acid. The results showed that more than twice as many carbon atoms derived from the methylene group of glycine were incorporated as nitrogen atoms from the same amino-acid. About half the labeled carbon atoms were found in the methyne carbon fraction, while approximately one-quarter was found in each of of the two imides isolated. The methyl carbon atom of acetate was utilized more efficiently than the carboxyl carbon atom, and the activity of the former was found to an equal extent in both the imides, but not in the methyne carbon fraction. The activity of the carboxyl carbon atom of acetate was found chiefly in the hematinic acid. One or both of the vinyl carbon atoms were derived from the methyl carbon atom of acetate. Serine and formate were not utilized to any significant extent. It is suggested that one molecule of glycine is oxidized to glyoxylic acid and then condenses with another molecule of glycine to give either hydroxy-aspartic or amonofumaric acid. This four-carbon compound then condenses with two molecules of α-ketoglutarate to form a highly carboxylated pyrrole, which by further condensation with loss of carbon dioxide could give rise to porphyrins. 39 references. (auth)

5593 Biological Syntheses of Radioisotope-Labeled Compounds. Nathan H. Woodruff and E. Eugene Fowler. Nucleonics 7, No. 2, 26-41(1950) Aug. (See also NSA 4-115.)

This article is a summary of a number of reports involving the use of radioisotopes as tracers. The information presented in this paper is divided into the following categories: labeled materials from plants, labeled materials from animals, labeled materials from microorganisms, and a tabulation of isotope-labeled compounds prepared biosynthetically, and an extensive list of references.

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5594 Catalysis of Transamidation Reactions by Proteolytic Enzymes. Robert B. Johnston, Mary J. Mycek, and Joseph S. Fruton. J. Biol. Chem. 185, 629-41(1950) Aug.

Cysteine-activated papain catalyzes the replacement of the amide N of benzoylglycinamide by N^{15}, introduced into the reaction as isotopic ammonium N. This transamidation is favored by a shift in pH from 5 to 8. Cysteine-activated papain catalyzed the replacement of the amide NH_2 group of a number of acylamino acid amides by the $-NHOH$ group of hydroxylamine. The hydroxamic acids so formed have been estimated colorimetrically. As with the isotope experiments, a shift in pH from 5 to 7.5 markedly increases the extent of transamidation. Similar results have been obtained with a preparation of beef spleen cathepsin. The possible significance of these findings for the study of the biosynthesis of peptide bonds is discussed. 28 references. (auth)

5595 Conversion of Cystathionine Labeled with S^{35} to Cystine in Vivo. Julian R. Rachele, Lester J. Reed, A. R. Kidwai, Martha F. Ferger, and Vincent du Vigneaud. J. Biol. Chem. 185, 817-26(1950) Aug.

L-Cystathionine labeled with S^{35} was prepared and fed to rats for a period of 23 days. The cystine was isolated from the hair grown during this period and was found to be radioactive. The cystine was converted to 4-thiazolidinecarboxylic acid and the latter compound was subjected to two recrystallizations. The radioactivities of the isolated cystine and the recrystallized 4-thiazolidinecarboxylic acid were the same, within experimental error. Thus, the formation of cystine from cystathionine in the rat has been corroborated by the use of isotopic sulfur. The results are compared with those obtained in earlier feeding experiments with methionine labeled with S^{34} and with C^{13}. 25 references. (auth)

5596 On Deethylation of Ethionine in the Rat. Jakob A. Stekol and Kathryn Weiss. J. Biol. Chem. 185, 577-83(1950) Aug.

Ethionine, which was labeled with C^{14} in the methylene carbon of the ethyl group, was administered to rats and radioactive creatinine and choline were isolated from the tissues. The radioactivity of choline was confined to the trimethylamine moiety of the molecule. S^{35}-ethionine was administered to rats together with bromobenzene, and radioactive p-bromophenylmercapturic acid was isolated from the urine. The data suggest that ethionine sulfur is available to the rat for cysteine synthesis, implying deethylation of ethionine in vivo, and that the ethyl group of ethionine is available to the rat for the synthesis of ethyl analogues of substances which are known to participate in the so-called transmethylation reactions. It is suggested that the observed inhibition of growth by ethionine is probably due to the synthesis of these ethyl analogues in vivo. 14 references. (auth)

5597 Distribution and Effect of Colloidal Radioactive Gold in Peritoneal Fluid Containing Free Sarcoma 37 Cells. Horace Goldie and Paul F. Hahn. Proc. Soc.

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Exptl. Biol. Med. 74, 638-42(1950) July. (See also NSA 4-5369.)

Two to five days after intraperitoneal inoculation of 10,000 (in one series, 50,000) free sarcoma 37 cells from peritoneal fluid, several series of CFW mice were treated with a single intraperitoneal injection of 0.2 to 0.44 mc of colloidal radioactive gold. Control mice remained untreated or were treated with inactive (decayed) gold preparations. On 3 consecutive days after treatment, specimens of peritoneal fluid were withdrawn by exploratory puncture from treated and control mice. Stained smears from these specimens revealed the absence of tumor cells or cytological abnormalities therein in gold treated mice, while in controls the tumor cells were numerous and showed high proportion of mitoses. The nonviability of morphologically alterated cells was demonstrated by their inability to multiply or even to survive after their transfer into new mice. Ultramicroscopic colloidal gold particles mixed immediately after injection with the peritoneal fluid became condensed, after 24 to 48 hr, into dot-like particles in the cytoplasm of macrophages and during the following days into coarse clumps. The macrophages loaded with gold particles maintained their structural and functional integrity; lymphocytes and polymorphonuclears were partially and temporarily destroyed by radiation effect. It is concluded that in the cellular peritoneal exudate from mice inoculated intraperitoneally with S-37 cells, the tumor cells were highly sensitive to small amounts of radiation well tolerated by the mice themselves while macrophages showed very high resistance to the same agent. Thus, the complete destruction of free tumor cells in the peritoneal cavity of the mice may be described as a selective radiotherapeutic effect of radioactive colloidal gold. 12 references. (auth)

5598 The Distribution and Function of Zinc in Normal and Malignant Tissues. Part I. Uptake and Distribution of Radioactive Zinc, ^{65}Zn. J. C. Heath and J. Liquier-Milward. Biochem. et Biophys. Acta 5, 404-15(1950) June.

The uptake and distribution of Zn^{65} in normal and malignant mouse tissues and certain fractions derived from there have been studied following the injection of this element as chloride into tumor-bearing mice. In both the sarcoma and carcinoma studied the malignant tissue took up more of the Zn^{65} per unit weight of tissue in the given time of 18 hr than the normal tissue supporting tumor growth. Nuclear desoxyribose nucleoprotein from the tumor cells showed an appreciable content of Zn^{65} and, provided a suitable method of preparation was used, so also did liver-cell nuclei. (auth)

5599 The Distribution of Radiomercury of a Mercurial Diuretic in Some of the Body Fluids of Man. C. T. Ray, G. E. Burch, S. A. Threefoot, and F. J. Kelly. Am. J. Med. Sci. 220, 160-5(1950) Aug. (See also NSA 2-68.)

The distribution of radio-mercury ($Hg^{203,205}$) in edema fluid, ascitic fluid, pleural fluid, bile, saliva, gastric juice, cerebrospinal fluid, sweat, and erythrocytes following intravenous administration of a single dose of a mercurial diuretic is described. No measurable quantities entered the cerebrospinal fluid, sweat, gastric juice and erythrocytes, and only low concentrations were reached in the saliva, edema, peritoneal and pleural fluids. Relatively high concentrations were attained in the bile. (auth)

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5600 The Effect of Hypophysectomy, Adrenalectomy, and ACTH Administration on the Phosphorus Metabolism of Rats. Carl A. Gemzell and Leo T. Samuels. Endocrinology 47, 48-59(1950) July.

The turnover of inorganic phosphate between plasma and tissues in normal rats has been compared with that of animals which were adrenalectomized, hypophysectomized, or hypophysectomized and treated with adrenocorticotrophic hormone, using P^{32} as a tracer. Hypophysectomy markedly reduced the rate of turnover of inorganic phosphate between the cells and the extracellular fluids of all the tissues measured. The injection of adrenocorticotrophic hormone into the hypophysectomized rats increased the rate of turnover in all the tissues studied. The regulation of the plasma phosphate level depends on some other pituitary factor, probably the growth hormone.

5601 The Formation of Glycogen from C^{14}-Labeled Glycine. Harry N. Barnet and Arne N. Wick. J. Biol. Chem. 185, 657-61(1950) Aug.

With the use of the intact rat the specific activity of the glycogen formed after feeding carboxyl-labeled glycine shows that the carboxyl carbon of the administered glycine supplied approximately 1 carbon for each 28 carbon atoms incorporated into glycogen. Specific activity of the carbon glycogen obtained after feeding α-carbon labeled glycine shows that 1 carbon atom in every 8.5 carbon atoms in the glycogen molecule was derived from the α-carbon of the fed glycine. The C^{14} is eliminated at a more rapid rate and to a greater extent in the expired CO_2 in the case of the carboxyl-labeled glycine compared to that obtained after feeding α-carbon-labeled glycine. 17 references. (auth)

5602 Identification of Transplanted Tissues in Chick Embryos by Marking with Phosphorus-32. M. Abercrombie and G. Causey. Nature 166, 229-30(1950) Aug. 5 (Letter to the editor).

The technique of distinguishing between host and graft tissues of the chick by marking one or the other with P^{32} and afterward preparing an autoradiograph of serial sections of the operated embryo is described.

5603 Incorporation in Vivo of C^{14} from Labeled Methanol into the Methyl Groups of Choline. Vincent du Vigneaud and Walter G. Verly. J. Am. Chem. Soc. 72, 1049(1950) Aug.

A total of 9 ml of a 2.4% aqueous solution of C^{14}-labeled methanol with an activity of 5.33×10^{-6} cts/min/ml was injected subcutaneously, in 1-ml portions twice daily, into a 161-g rat over a 5-day period. During this time the animal was kept in an open-circuit metabolism apparatus for the collection of the expired carbon dioxide. During the 5-day period a radioactivity of 22×10^{-6} cts/min, out of the total injected radioactivity of 48×10^{-6} cts/min, appeared in the expired carbon dioxide. The animal was then sacrificed; choline was isolated from the carcass as the chloroplatinate. No exchange of methyl groups was found to occur between choline and C^{14}-labeled methanol, allowed to stand together for several days.

5604 Influence of Adrenal Cortical Steroids and Related Compounds on Sodium Metabolism. Ralph I. Dorfman. Proc. Soc. Exptl. Biol. Med. 72, 395-8(1949).

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Eleven steroid compounds have been studied as to their influence on sodium excretion (using NaCl and radiosodium) in adrenalectomized rats. Desoxycorticosterone caused significant retention at 1 μg, and the acetate was effective at 25 μg, the lowest concentration studied. Δ^4-pregnenol-21-trione-3,12,20-21- acetate gave a significant retention at 1340 μg. 17-Hydroxycorticosterone caused a significant excretion of sodium. The following steroids were found to be negative: 11-dehydrocorticosterone acetate (100 μg), pregnanetrione-3,11,20 (200 μg), corticosterone (400 μg), allopregnanepentol-3 (β), 11(β), 17(α), 20, 21-3(β), 20, 21-triacetate (800 μg), allopregnanetriol-3 (β), 17(α), 21-one-20 (800 μg), testosterone (2000 μg), estradiol (2000 μg), and pregnanetrione-3,12,20 (2000 μg). (auth)

5605 Inhibition of Nucleic Acid Synthesis by Folic Acid Antagonists. Howard E. Skipper, Jack H. Mitchell, Jr., and Leonard L. Bennett, Jr. Cancer Research 10, 510-12(1950) Aug.

Aminopterin and A-methopterin, well known folic acid antagonists, have been shown to inhibit the incorporation of C^{14} from formate into nucleic acids and nucleic acid purines. Under the conditions of these experiments, incorporation of $C^{14}O_2$ into purines was partially blocked, but no decrease was observed in tissue CO_2 fixation. The relationship of these observations to the mechanism of action of folic acid in purine synthesis and the anti-leukemic mechanism of "folic acid inhibitors" is discussed. 13 references. (auth)

5606 Labeled Sulfur Uptake by Thyroids of Rats with Low Plasma Thiocyanate Levels. John L. Wood and Nelson Kingsland. J. Biol. Chem. 185, 833-7(1950) Aug.

Approximately 0.75 μM of thiocyanate ion labeled with S^{35} was injected into rats. Determinations of the labeled sulfur in the thyroids and serums were made after intervals of 0.5 to 5 hr. The concentration gradients between the thyroids and serums were of the same magnitude as reported for blood levels up to 1000-fold greater. The percentage uptake of the dose was about one-hundredth the uptake of a similar dosage of iodide. Thyroids made deficient in iodine by a low iodide diet, or by propylthiouracil administration, showed no greater uptake of thiocyanate ions than normal thyroids. 15 references. (auth)

5607 Mechanism of Absorption of Inorganic Phosphate from Blood by Tissue Cells. G. Popjak. Nature 166, 184-5(1950) July 29.

Rabbit liver left in situ was perfused with homologous plasma to which a small amount of carrier-free inorganic $P^{32}O_4^{3-}$ was added (2 to 5 μc/l) with or without 0.01M sodium azide. The heparinized plasma, after addition of P^{32} in saline, was divided into two equal volumes, to one of which sodium azide was added; the two lots were used for the control and experimental perfusions, which were carried out on the liver of litter-mate animals. By the 14th min of perfusion the outflow from the liver was clear plasma uncontaminated by red corpuscles, and therefore it was assumed that after the 14th min all the P^{32} which disappeared from the perfusion fluid was due to absorption by the liver. Sodium azide inhibited severely the absorption of inorganic phosphate from the plasma. The average absorption of phosphorus by the liver in the control perfusions was 14 μg/min and in the perfusions with azide 3.6 μg/min after the 14th min of perfusion. This difference amounts to a 74% inhibition. The action of azide in inhibiting phosphorylation is discussed.

5608 The Metabolism of Arsenic in Laboratory Animals Using As^{74} as a Tracer. Henry Lanz, Jr., Patricia C. Wallace, and Joseph G. Hamilton. Univ. Calif. (Berkeley) Pubs. Pharmacol. 2, 263-82(1949) May 15.

The metabolism of arsenic was studied, following intramuscular injection of $Na_3As^{74}O_4$ into rats, dogs, and other animals.

5609 The Metabolism of Phenylalanine and Tyrosine in Mutant Strains of Escherichia Coli. Sofia Simmonds. J. Biol. Chem. 185, 755-62(1950) Aug.

A phenylalanine-requiring mutant of Escherichia coli strain K-12 has been found to produce a growth factor for a tyrosine-requiring mutant of the same parent strain and for Lactobacillus arabinosus. When the phenylalanineless strain is cultured in minimal medium containing L-phenylalanine as the only amino acid and $N^{15}H_4^+$, it synthesizes and elaborates tyrosine containing N^{14} into the medium. Since the total quantity of tyrosine in the bacterial cells and in the culture filtrate is much greater than the quantity of L-phenylalanine supplied in the medium, the carbon skeleton of tyrosine cannot be entirely derived from the exogenous phenylalanine. The phenylalanineless strain exhibits diphasic growth curves when it is cultured for long periods in minimal medium containing suboptimal concentrations of L-phenylalanine. The first phase of such curves represents growth due to the utilization of phenylalanine supplied in the medium, and the second phase growth in the absence of an exogenous source of phenylalanine. Evidence is presented to demonstrate that the secondary growth is not the result of a spontaneous loss, by the bacteria, of their phenylalanine requirement, but that the mutant elaborates into the medium, a substance which can serve as a growth factor in place of phenylalanine. (auth)

5610 The Metabolism of S^{35}-Sodium Estrone Sulfate in the Adult Female Rat. Donald J. Hanahan and N. B. Everett. J. Biol. Chem. 185, 919-25(1950) Aug.

The metabolism of a conjugated estrogen, S^{35}-sodium estrone sulfate, in the adult female rat was studied. More than 75% of the S^{35} of the radioactive estrogen given to female rats by intravenous, subcutaneous, or gastric injection was found in the urine and feces in 36 hr. All the excreted S^{35} was inorganic in nature. Administration of S^{35}-sodium estrone sulfate, by subcutaneous or intravenous injection, to bile fistula female rats resulted in the excretion of less than 15% of the S^{35} in the bile; the remaining S^{35} was found in the urine and feces. Again all the S^{35} excreted was inorganic in nature. Various organ homogenates were examined for enzyme systems capable of hydrolyzing this conjugated estrogen. Liver homogenate was the only one examined that was capable of effecting a hydrolysis of this ester. (auth)

5611 Oxygen Consumption and Radiophosphate Uptake by Minced Brain from Mice of Different Ages in Relation to Propagation of Mouse Encephalomyelitis

Virus. Max E. Rafelson, Jr., Harold E. Pearson, and Richard J. Winzler. Science 112, 231-2(1950) Aug. 25.

Experiments are reported in which a P^{32} tracer was used to determine whether oxidative or glycolytic metabolism differences in brains of mice of different ages might be associated with the inability of older tissues to support virus propagation.

5612 Previous Nutritional State and Glucose Conversion to Fatty Acids in Liver Slices. E. J. Masoro, I. L. Chaikoff, S. S. Chernick, and J. M. Felts. J. Biol. Chem. 185, 845-56(1950) Aug.

The conversion of C^{14}-labeled glucose to fatty acids and CO_2 was studied in surviving liver slices prepared from rats that had been fasted and from rats fed diets in which the carbohydrate, fat, and protein contents were varied. The conclusion is drawn that dietary carbohydrate is essential for maintenance of the capacity of hepatic tissue to convert glucose to fatty acids.

5613 Radioactive Crystalline Ribonuclease. Christian B. Anfinsen. J. Biol. Chem. 185, 827-31(1950) Aug.

Radioactive, crystalline ribonuclease has been prepared in vitro by incubation of bovine pancreas slices with $C^{14}O_2$. This protein contains incorporated radioactivity at approximately twice the level of the average slice proteins. Following repeated recrystallization of the radioactive enzyme diluted with nonradioactive carrier, a product was obtained which obeyed phase rule criteria of purity within narrow limits. The data suggest that the small amount of impurity present is mainly denatured ribonuclease. (auth)

5614 Radioactive Isotopes in Biological Experiment. W. P. Rogers. Australian Chem. Inst. J. Proc. 17, 101-11(1950) Mar.

A general discussion is presented of the application of tracer methods to biological research. 26 references.

5615 Radioactive Isotopes in Poultry Nutrition. C. L. Comar and O. E. Goff. Poultry Comment 7, No. 4, 1-3(1950) July.

This article is a brief report on methods employed in administering radioactive isotopes to poultry for metabolism studies. Results of some experiments are included.

5616 Some Effects of the Hypophysis on Iodine Metabolism by the Thyroid Gland of the Rat. W. P. Vanderlaan and Monte A. Greer. Endocrinology 47, 36-47(1950) July.

The thyroid gland of the rat has been shown to be dependent on the presence of thyrotropic hormone for its capacity to concentrate iodine from the serum, to bind iodine to protein, and to discharge thyroid hormone. Tracer I^{131} was used to determine the thyroid/serum ratio.

5617 Stable Isotopes in Absorption and Nutritional Investigations. Tracer Elements Bibliography No. 20A. Commonwealth X-ray and Radium Laboratory. T. H. Oddie. Jan. 4, 1950. 6p. (AEC File No. NP-1646.)

References are given to the chemistry of biochemical compounds labeled with stable isotopes including syntheses, reaction mechanisms, and analysis, and to nutrition studies,

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including those on carbohydrates, fats and lipids, proteins, amino acids, and other nitrogen compounds. 58 references.

5618 Studies in Congenital Porphyria. 1. Incorporation of ^{15}N into Coproporphyrin, Uroporphyrin and Hippuric Acid. C. H. Gray and A. Neuberger. Biochem. J. 47, 81-7(1950) June-July. (See also NSA 4-2974.)

Glycine containing 31.65 at. % excess N^{15} was fed to a patient suffering from congenital porphyria. The fecal and urinary coproporphyrin samples isolated during the first few weeks of the experiments had high N^{15} content which decreased with time. The urinary uroporphyrin samples had somewhat lower N^{15} content. It is suggested that the differences in isotope content observed may be explained by differences in the degree of storage of uroporphyrin and coproporphyrin in the body. Sodium benzoate was administered to a normal man and to the porphyric. The N^{15} content of the hippuric acid isolated indicate that administration of benzoic acid stimulates a mobilization of glycine from proteins, or the synthesis of glycine from nitrogen-free precursors, or both. 11 references. (auth)

5619 Studies in Congenital Porphyria. 2. Incorporation of ^{15}N in the Stercobilin in the Normal and in the Porphyric. C. H. Gray, A. Neuberger, and P. H. A. Sneath. Biochem. J. 47, 87-92(1950) June-July.

The N^{15} content of stercobilin samples collected over a period of 180 days after feeding labeled glycine to a normal subject have been determined. The highest N^{15} content was observed in samples obtained between the 120th and 150th day of the experiment, at a time when the rate of breakdown of the labeled circulating haem was highest. A second peak was observed in the first few days of the experiment; this is assumed to be caused by a breakdown of hemoglobin during the maturation of the red cell. Other explanations for this phenomenon are discussed. The stercobilin samples obtained between the 30th and 100th day of the experiment contained small amounts of N^{15}. It is suggested that this fraction may largely represent bile pigment formed from haem proteins other than hemoglobin. In a similar experiment with a congenital porphyric it was found that the isotope content of the stercobilin was very high in the first 2 to 3 weeks of the experiment; the peak corresponding to the breakdown of circulating hemoglobin was not very marked. Evidence is presented to indicate that the stercobilin excreted by the porphyric has the same structure as that obtained from normal subjects. 10 references. (auth)

5620 A Study of the Oxidation of Alcohol in the Rat by Means of C^{14}-labeled Ethanol. Lubomir Dontcheff. Compt. rend. 231, 177-8(1950) July 10 (in French).

$C^{14}O_2$ elimination curves in rats have been set up by injecting them intraperitoneally with a 20% solution of labeled alcohol and following its oxidation. An important part of the ethanol is oxidized immediately, but a certain proportion of it must take part in synthetic reactions which have not been specified. (auth)

5621 The Threshold for the Disappearance of Diiodofluorescein from Circulating Blood. A. H. W. Aten, Jr., J. Halberstadt, and G. P. M. Horsten. Rev. Med. Liege 5, 428-9(1950) Aug. 1 (in French).

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Ten milliliters of iodine-labeled (I^{131}) diiodofluorescein was injected intravenously into dogs and its retention in the blood was measured from 4.5 min to 21 hr after injection. It was found that it disappeared very rapidly from the blood, the supposition being that it is absorbed by tumors.

5622 Tracer Experiments in Mammals with Dicumarol Labeled with Carbon-14. J. W. T. Spinks and L. B. Jaques. Nature 166, 184(1950) July 29 (Letter to the editor).

Fourteen mice were each given 0.25 mg C^{14} labeled dicumarol by intravenous injection. At various times after the injection, the animals were sacrificed, the tissues were weighed, and radioactivity was determined. No significant amount of activity could be detected in the lungs, kidney, and tissues in general; but large amounts of activity were found in the liver, gall bladder, feces, and urine. 80% of the activity disappeared from the blood in the first hr following injection. A series of rabbits was similarly given 10 mg each of labeled dicumarol. A similar distribution of radioactivity was found in these animals with a rapid disappearance of dicumarol from the blood and a rapid increase of activity in the liver. By means of the isotope dilution procedure, it was shown that the activity found in the liver was essentially all unchanged dicumarol. By contrast, although a large percentage of the activity was recovered in the urine at the end of the experiment, none of the activity in the urine was due to dicumarol. In further experiments, mice were injected with labeled dicumarol together with vitamin K. It was found that, for the animals receiving the vitamin, activity appeared in the liver immediately after the injection; but that in the following hours, the activity disappeared from the liver much more quickly than for the animals not receiving vitamin K. These results demonstrate that the liver constitutes the target organ for the action of dicumarol, and they suggest that the period of time during which dicumarol remains in the liver is related to the effectiveness of this agent in interfering with the formation of prothrombin.

5623 Tracer Studies of Glucuronic Acid Biosynthesis. Erwin H. Mosbach and C. G. King. J. Biol. Chem. 185, 491-8(1950) Aug.

Glucuronic acid synthesis by borneol-treated guinea pigs was investigated by radioactive tracer techniques. Of the administered glucose activity, 1.79 to 4.05% was recovered in urinary bornyl glucuronide within 24 hr. After a similar interval only 0.18 to 0.29% of administered C^{14}-sodium bicarbonate activity was found in urinary bornyl glucuronide, and no radioactivity was detectable in the glucuronic acid following an injection of 1-C^{14}-L-ascorbic acid. Partial degradation of the isolated glucuronic acid indicated that it contained the same ratio of C^{14} in position 6, compared to total activity, as that observed in the initial glucose. Hence, the carbon chain of glucose is used directly for glucuronide synthesis, or the sequence of steps does not permit a dilution effect in other positions during fragmentation. 26 references. (auth)

5624 The Uptake of Radiocalcium by the Skeleton: The Effect of Vitamin D and Calcium Intake. Harold E. Harrison and Helen C. Harrison. J. Biol. Chem. 185, 857-67(1950) Aug.

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Rachitic, vitamin D-treated rachitic, and control rats have been given $Ca^{45}Cl_2$ solution by stomach tube and the radioactivity and total calcium content of blood serum and skeleton determined after 2-hr to 2-week intervals. All the bone calcium of young rats rapidly exchanges with body-fluid calcium. The time necessary for exchange of 50% of total skeletal calcium in 6- to 8-week-old rats is approximately 45 hr in vitamin D-treated rats and 65 hr in rachitic rats. Changes in dietary calcium intake do not appreciably influence the exchange rate in any group. Epiphyseal bone calcium reaches equilibrium with serum calcium more rapidly than does that of diaphyseal bone. In proportion to total skeletal calcium, exchange is much slower in older (15 to 20 week) rats. Because of rapid exchange, the Ca^{45} uptake by the skeleton cannot be used as a measure of new bone salt deposition.

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5625 Zirconium-Chloranilate Complexes. Burton J. Thamer and Adolf F. Voigt. AECU-879, nd. 14p.

To reduce effects of hydrolysis and polymerization, zirconium was studied in 1M to 2M perchloric acid with lithium perchlorate to keep the ionic strength at 2. In 2M perchlorate solutions the dissociation constants of chloranilic acid (2,5-dichloro-3,6-dihydroxyquinone) were determined to be $(84 \pm 4) \times 10^{-3}$ and $(38 \pm 1) \times 10^{-4}$ by spectrophotometric measurements. The second ionization is of more than usual strength relative to the first due to the strong resonance in the doubly negative ion. At zirconium and chloranilic acid concentrations near 10^{-5} only the one-to-one complex is formed in appreciable concentrations. It has a deep magenta color and appears to be quite useful as a colorimetric analytical test for zirconium. In its formation two hydrogen ions are liberated per zirconium complexed. The stoichiometric instability constant is $175 \pm 2) \times 10^{-8}$. In addition to this, at concentrations of excess chloranilic acid in the neighborhood of 10^{-4} to 10^{-3}, a second complex is formed. It has a zirconium-to-chloranilic-acid ratio of 1 to 2. In its formation from the first complex 1.8 ± 0.5 hydrogen ions are liberated. Assuming two hydrogen ions to be involved, the instability constant of the second complex going to the first is $(17 \pm 1) \times 10^{-5}$. (auth)

5626 On Basic Concepts in Surface Thermodynamics. Robert S. Hansen. AECU-880, nd. 12p.

It is shown that, in the case of inert, nonswelling solid adsorbents, measured gas- or liquid-solution adsorption quantities are related to Gibbsian surface excesses by multiplicative, experimentally determinable constants. The discussion is based on actual experimental procedures. In the case of gas adsorption, measured quantities are most directly related to surface excesses referred to a mathematical surface located by setting the surface excess of the solid component equal to zero ("1" convention). In the liquid solution case measured quantities are most directly related to the "V" convention surface excesses of Guggenheim and Adam (Proc. Roy. Soc. (London) 139A, 218(1933)), but in general these may be expected to be substantially equal to those defined by the "1" convention. (auth)

5627 Solubility of Perfluoro-n-Heptane with Benzene, Carbon Tetrachloride, Chloroform, n-Heptane and

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2,2,4-Trimethylpentane. J. H. Hildebrand, B. B. Fisher, and H. A. Benesi. AECU-883, nd. 9p.

Liquid-liquid solubility curves have been determined for binary mixtures of perfluoro-n-heptane with benzene, carbon tetrachloride, chloroform, n-heptane and 2,3,4-trimethylpentane. The critical temperatures obtained from these curves were 113.5, 58.7, 78.5, 50.0 and 23.7°C, respectively. Solubility parameter differences calculated from experimental results were in close agreement with values predicted by solubility theory for all but the last two paraffin hydrocarbons listed above.

5628 Ionization and Hydration Equilibria of Periodic Acid. C. E. Crouthamel, A. M. Hayes, and D. S. Martin. AECU-915, nd. 23p.

Variations in the absorption characteristics of periodate solutions with pH and temperature have been used the better to determine the species present in dilute aqueous solutions. The species H_5IO_6, $H_4IO_6^-$, IO_4^-, and $H_3IO_6^{-2}$ and their equilibria were sufficient to explain the spectrophotometric and potentiometric data of periodate solutions in pH ranges 0 to 7 and temperature ranges 0 to 70°. Apparent and true constants for these ionization and hydration equilibria have been evaluated at 25°. (auth)

5629 Progress Report for March, 1950. Carl G. Moore, D. S. McKinney, and J. C. Warner. NYO-544, nd. 10p.

This report summarizes and discusses results on the overvoltage of titanium and zirconium. Variations in surface impurities are believed to be the cause of the varying cathodic behavior of different specimens of titanium and zirconium. Drifts in hydrogen overvoltage with time are believed to be due principally to the formation of hydride at high current densities and to the formation of an oxide film having high electrical resistance at low current densities. Both metals show sufficiently high hydrogen overvoltage that no additional corrosion difficulties should be experienced when they are joined to other metals. (auth)

5630 Partial Purification of a Nonphosphorylytic Uridine Nucleosidase from Yeast. C. E. Carter. ORNL-757, Aug. 7, 1950. 17p.

From yeast plasmolysates an enzyme has been partially purified by ammonium sulfate fractionation which degrades uridine to uracil and ribose in the absence of inorganic phosphate or arsenate, and which does not hydrolyze other ribosides. The finding of a hydrolytic pyrimidine nucleosidase in plasmolyzed yeast extracts suggests that a mechanism of synthesis and degradation of ribosides alternative to the previously described phosphorylytic nucleosidases exists in nature.

5631 Enzymatic Evidence for the Structure of Desoxyribonucleotides. C. E. Carter. ORNL-758, Aug. 7, 1950. 16p.

Desoxyribonucleotides prepared by enzymatic degradation of thymus desoxyribonucleic acid and isolated by ion-exchange chromatography are dephosphorylated by an enzyme isolated from bull semen which hydrolyzes the phosphate group of adenosine-5′-phosphate (and inosine-5′-phosphate) and is inactive against all other ribonucleotides. Desoxy-

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adenylic acid is deaminated by muscle adenylic acid deaminase. The phosphate group of desoxyadenylic acid is labile in acid and alkali, whereas the phosphate group of adenosine-5′-phosphate is relatively resistant to hydrolysis. These data are interpreted to support a 5′-nucleotide structure of desoxynucleotides. The ease of acid and alkaline hydrolysis of the phosphoester group in the purine desoxyribonucleotides is probably a reflection of the general chemical lability of these compounds. (auth)

5632 Proposed Method of Determining the Vapor Pressure of Zirconium Tetrachloride and Hafnium Tetrachloride in the Liquidus Region. G. H. Clewett and D. W. Kuhn. Y-430, June 20, 1949. 3p.

Several proposed direct methods are described to measure the vapor pressure of zirconium and hafnium tetrachlorides in the liquidus region. An alternate indirect method is also described whereby the vapor pressure can be calculated for a knowledge of the heat of sublimation and fusion. The anticipated errors in the latter are discussed.

5633 The Kinetics of the Zirconium-Nitrogen Reaction at High Temperatures. Andrew Dravnieks. J. Am. Chem. Soc. 72, 3568-71(1950) Aug.

The kinetics of the zirconium-nitrogen reaction have been studied between 862 and 1043°. The initial rate obeys the parabolic law with an activation energy of 52 kcal and is independent of pressure. For reactions of long duration the rate increases compared to the initial parabolic rate; this change is probably due to volume changes of the metal phase. The rate constants are sensitive to the origin of the zirconium samples. (auth)

5634 An Empirical Titrimetric Method for the Determination of Beryllium. John H. McClure and Charles V. Banks. AECU-812, nd. 12p.

The Craig method (J. Soc. Chem. Ind. 30, 184-5(1911)) for titrating aluminum has been modified and applied to the determination of beryllium. This method consists of adjusting the pH of a solution of beryllium to 8.5 followed by the addition of sodium or potassium fluoride and titration of the liberated sodium hydroxide with a standard acid solution. A precision of better than two parts per thousand is obtained. A glass electrode is used for the pH adjustments. 17 references. (auth)

5635 Spectrophotometric Determination of Nickel in Calcium Metal Using Nioxime (1,2-Cyclohexanedionedioxime). Raymond C. Ferguson and Charles V. Banks. AECU-878, nd. 18p.

Reactions of nioxime and heptoxime with nickel in the presence of oxidizing agents are quite similar to the reaction of dimethylglyoxime. The applicability of the red nickelous nioxime complex to the colorimetry of nickel is established. The complex can be stabilized with gum arabic, absorbs most strongly at 550 mμ, is insensitive to pH changes, and obeys Beer's law. The effects of diverse ions are discussed and the method is applied to the determination of nickel in calcium metal. 24 references. (auth)

5636 Nitrogen and Oxygen Isotope Effects in the Decomposition of Ammonium Nitrate. Isotope Analysis of

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Nitrates for O^{18}. Jacob Bigeleisen and Lewis Friedman. AECU-901, nd. 1p.

The document is reproduced below in its entirety.

Oxygen and nitrogen isotope effects in the thermal decomposition of ammonium nitrate into nitrous oxide and water have been investigated. The experimental results will be presented and compared with theoretical calculations. The isotopic analysis of water for O^{18} from the decomposition of ammonium nitrate can be used to analyze nitrates for O^{18}. The decomposition of $N^{15}H_4N^{14}O_3$ leads exclusively to the isotopic isomer $N^{15}N^{14}O$. The mass spectrometric determination of the structure will be presented. (auth)

5637 Use of a Modified Syringe for Extraction with Solvents of Low Density. A. I. Medalia and R. W. Stoenner. AECU-909, nd. 4p.

In many of the extraction procedures of value in analytical chemistry, a solvent is used, such as ethyl or isopropyl ether, which is less dense than the aqueous medium from which the substance in question is being extracted. In this paper a method is described by means of which repeated extractions may be carried out without transfer of the denser phase out of the apparatus. As a test of the completeness of extraction with the apparatus described, extraction of ferric chloride with isopropyl ether was carried out, as recommended by Dodson, Forney and Swift (J. Am. Chem. Soc. 58, 2573(1936)).

5638 Quantitative Spectrographic Analysis of Zirconium-Hafnium Mixtures. Velmer A. Fassel and Charles H. Anderson. AECU-919, nd. 24p.

A spectrographic method for the analysis of zirconium-hafnium mixtures covering the hafnium/zirconium concentration ratio range from 0.001 to 100 is described. The samples are excited as conducting pellets prepared from mixtures of the combined oxides with powdered flake graphite. An overdamped condenser discharge is used for excitation. By utilizing a series of internal-standard line pairs, the complete concentration range can be covered by a single exposure. At the same time, photographic photometry errors can be reduced by restricting the intensity-ratio range over which these line pairs are measured. The unique similarity in the physical and chemical properties of zirconium and hafnium combined with the use of line pairs of similar excitation characteristics provides a system in which almost ideal internal-standard compensation can be achieved. Experimental results indicate that large variations in excitation conditions, the presence of up to 5% extraneous elements, variations in graphite-oxide ratios in the pellet, change in crystal structure of the oxides and in the chemical form of the samples apparently have no effect on the analytical results. Precision determinations show a standard deviation of about 1.5 to 2.0%. 38 references. (auth)

5639 A Rapid Method for the Determination of Radioiodine. Milton Lewis. HW-18151, June 23, 1950. 12p.

A rapid method for the determination of radioiodine has been developed. The method is based on the extraction of iodine with carbon tetrachloride, as are the older methods. A continuous extractor, however, makes it possible to carry out the determination quickly and with a minimum of manipulation. Advantage is taken of the gamma radiation from the iodine isotopes by using the Shonka chamber (a high pressure ionization chamber) for making the radio-chemical measurements. The chemical yield is obtained by means of the Volhard volumetric determination of iodide ion. (auth)

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5640 The Acidimetric Determination of Aluminum with Fluoride at pH 10-11. S. A. Hays. HW-18178, June 27, 1950. 12p.

The precipitation of potassium aluminum fluoride from an aqueous aluminate solution by potassium fluoride releases hydroxyl ion by the reaction

$$KAlO_2 + 6KF + 2H_2O \rightarrow K_3AlF_6 + 4KOH.$$

Titration of the hydroxyl ion with standardized HCl provides a measure of the aluminum in the sample. The solution is adjusted to a measured pH which corresponds to a point on the steepest part of the titration curve; after the addition of precipitant the suspension is back-titrated to this same pH. The base freed by the reaction, and equivalent to the aluminum content, is thus measured. The method is particularly advantageous for samples containing carbonate, dichromate, ammonium, uranium, or iron. Summaries are presented of the history of comparable methods and of the major types of interferences, reasons for specificity, optimum conditions, suggested procedure, and advantages of this method. (auth)

5641 The Spectrochemical Analysis of Lithium Metal. J. Y. Ellenburg, L. E. Owen, and V. P. Calkins. NEPA-1513, July 26, 1950. 14p.

The porous cup electrode method developed by Feldman (Anal. Chem. 21, 1041(1949)) has been applied to the analysis in Li metal of B, Be, Cr, Co, Fe, Ni, Nb, Mn, Mo, Ta, Ti, V, W, and Zr in the range 0.0001 to 0.1%. The scheme for the chemical separation of these elements from the Li matrix and the preparation of solutions for excitation, using Pt as an internal standard, is described, and spectral lines found suitable for densitometer intensity-ratio measurements in various concentration ranges are given.

5642 Solvent Extraction of Inorganic Ions. Fifth Quarterly Progress Report. L. G. Bassett, W. H. Bauer, H. M. Clark, S. E. Wiberley, and J. Savolainen. NYO-610, May 1, 1950. 20p.

Investigation of the interaction between proton donors and various proton accepting solvents has been extended. For substances containing an ether linkage, the shift of the C-O-C band in the infrared region due to the formation of a hydrogen bond with chloroform has been measured. This shift is too small to serve as the basis for a correlation between the magnitude of a band shift for a solvent due to hydrogen bonding and the solubility of a substance such as uranyl nitrate in the solvent. In the case of amines, a correlation exists between the hydrolysis constant of an amine and the magnitude of the shift of the O-D band in heavy methanol resulting from interaction between the amine and heavy methanol. The refractometric method for investigating inorganic complexes in aqueous solutions has been applied to the cupric chloride - hydrochloric acid and the ferric chloride - hydrochloric acid systems. In agreement with published data, evidence for complex formation has been found for the cupric chloride - hydrochloric acid system. When applied to the ferric chloride - hydrochloric acid system, however, the method was found to be unsuitable for the detection of known complexes. (auth)

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5643 Potentiometric Titrations of Beryllium. George F. Kosel and William F. Neuman. UR-106, Feb. 1, 1950. 23p.

To gain information relating to the mechanism of beryllium's physiological effects (Hyslop, F., et al, Nat'l. Inst. of Health Bull. No. 181(1943)) it was desirable to know what biologically important substances might interact with beryllium in aqueous medium, particularly in the region of near-neutrality. To "screen" a large number of chemical compounds for their ability to form undissociated complexes with beryllium, the technique of potentiometric titration was chosen. This method reveals interaction only if the complex ions formed are highly undissociated. It has been possible to correlate complex-formation with chemical structure. Thus, beryllium showed very little affinity for $-SH$ or $-NH_2$ groups. Hydroxyl or carboxyl groups were ineffective singly. In proper combination, as in malate or citrate, they formed very stable complex ions. Phosphate, polyphosphate, and their organic analogues were also effective complexers. Beryllium also showed some specificity in its interaction with protein. (auth)

5644 Comparison of Calcium-45 Oxalate and Carbonate Precipitates for Radioactive Assays. Ray L. Shirley, Riley Deal Owens, and George K. Davis. Anal. Chem. 22, 1003-4(1950) Aug.

Preparation of suitable precipitates for radioactivity assays of Ca^{45} by the calcium oxalate and calcium carbonate methods was studied. The oxalate precipitate was found to have greater capacity to absorb beta particles than the carbonate precipitate. This was expected because of the difference between the average atomic numbers of the two substances. The difference in self-absorption between the two types of precipitates is not great enough to affect size of samples required for routine analysis. Interference of magnesium, phosphorus, and aluminum was studied in regard to weight of precipitate and influence on activity measurements. Magnesium altered the gross absorption coefficient of the carbonate precipitate, but otherwise caused no interference. Both phosphorus and aluminum markedly interfered with the rate of filtration of the carbonate precipitate. In the case of the oxalate procedure, aluminum and phosphorus caused no interference when present alone, but when present together in the range of 50 mg each, large discrepancies in weight of a precipitate and in apparent specific activity were observed. Because of the common presence of interfering ions, the oxalate method is indicated to be more satisfactory than the carbonate procedure for the preparation of calcium precipitates for radioactivity assays, especially in biological materials. (auth)

5645 Electrometric Titrations of Zirconium and Hafnium Solutions. Edwin M. Larsen and Adrian M. Gammill. J. Am. Chem. Soc. 72, 3615-9(1950) Aug.

The pH of precipitation of hafnium hydroxide is always higher than for zirconium hydroxide for the perchlorate, nitrate, and chloride solutions at equivalent concentrations. The difference in the pH of precipitation for zirconium and hafnium from perchlorate solutions is very small, but the difference is quite marked in the nitrate and chloride solutions. The zirconium precipitates at progressively lower ratios of hydroxyl ion added to the metal ion concentration as the metal ion concentration is reduced, whereas the hafnium precipitates at nearly constant ratios. Increased anion concentration increases the pH of precipitation in all cases. For the sulfate solutions, the hafnium precipitates at lower pH's than the zirconium. The precipitates were probably basic sulfates. For the perchlorate solutions, over three-fourths of the precipitation range, the logarithm of the hydroxyl ion concentration is a linear function of the metal ion concentration. From the slope of -0.6, the average formula of the ion in solution is shown to be $(M(OH)_{3.4}^{+0.6})_n$. Solubility products for zirconium and hafnium hydroxides are calculated. 11 references. (auth)

5646 Hafnium-Zirconium and Tantalum-Columbium Systems. Quantitative Analysis by X-ray Fluorescence. L. S. Birks and E. J. Brooks. Anal. Chem. 22, 1017-20(1950) Aug.

The x-ray fluorescence analysis method was adapted to the determination of small amounts of hafnium in zirconium and of tantalum in columbium. Curves of the relative intensity of spectral lines of tantalum and columbium or hafnium and zirconium were plotted against percentage composition by using prepared standard compositions. As an example of the accuracy attainable, with a counting time of 3 to 5 min on a 0.5 at. % specimen of tantalum in columbium, the probable error in tantalum content due to statistical fluctuations of the Geiger counter was 0.02%, or 4% of the amount present. (auth)

5647 Rapid Determination of Bismuth in Bismuth-Tin and Bismuth-Tin-Cadmium Alloys. C. Goldberg. Metallurgia 42, 108(1950) July.

Experiments carried out with a Fisher "Electroanalyzer," and platinum gauze electrodes, showed that the electrodeposition of bismuth is quantitative in the presence of tin if the latter is complexed with hydrofluoric acid. Reproducibility of results is shown in one table and typical results for bismuth-tin-cadmium alloys are demonstrated in a second table.

5648 Structure of $BaTiO_3$. Edward G. Grimsal. AECU-884, nd. 7p.

The intensity of the x-ray reflected beam from various planes of $BaTiO_3$ was measured and from the data, the structure factor, F, was calculated using various values of titanium and oxygen displacements to obtain the best fit consistent with the reflection data. Two sets of pictures were taken, the crystal being rotated about the a and a + b axes, respectively. From an examination of the structure factors for these planes we see that the intensity ratios are quite sensitive to the titanium displacement and very insensitive to any displacement of the oxygen, particularly when the low value of the oxygen atom factor in this region is considered. Thus it appears that there is a displacement of both the titanium and the oxygen. The evidence for the titanium displacement is very conclusive and a definite value of 0.045 ± 0.015 A can be given for it. The oxygen displacement is believed to be of the order of 0.07A, although the author states that the evidence is not as conclusive as it is for titanium.

5649 Structure of the Silver Perchlorate-Benzene Complex. R. E. Rundle and Jeanne H. Goring. AECU-904, nd. 3p.

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Benzene acts as a Lewis base under a number of circumstances, but it is as yet unknown whether the acid is bonded to one carbon, or by π bonds, to two, or as more often suggested, equally to six carbons. The problem is interesting due to possible implications in organic reaction mechanisms. We have examined the silver perchlorate-benzene complex to aid in settling this question. Crystals $AgClO_4.C_6H_6$, prepared by crystallization of $AgClO_4$ from benzene, are orthorhombic, $a_0 = 7.96$, $b_0 = 8.34$, $c_0 = 11.7$ A, $\rho_{obsd} = 2.4$, $Z = 4$, space group Cmcm, Cmc, or C2cm. Patterson and, subsequently, Fourier projections on (100), (010), and (001) have been made. On Fouriers, carbon and oxygen peaks are resolved, leading to a structure based on C_{mcm}. Ag and Cl are in 4(c) with $y_{Ag} = 0.04$, $y_{Cl} = 0.44$. Benzene centers are in 4(a) with the normal to the ring making an angle of about 40 deg with c_0. Bond lengths C–C and Cl–O appear normal. The complete structure, after refinement, will be published elsewhere. Definite, though weak, Ag-benzene interactions are indicated by Ag–C distances of 2.6A, leading to an electron density of 0.15 pairs per bond by Pauling's rule and radii. Each silver is bonded equally to two carbons of each of two rings, lying above and below the rings, suggesting π bonding. The perchlorates are pushed away from one side of Ag^+ to make room for benzene. Benzene may act differently with other Lewis acids or with Ag^+ in solution. But if the silver positions in the crystals are influenced by the availability of π electrons from benzene, as appears to be the case, then the axial position cannot be materially more favorable than a position over two carbon atoms, and it may be considerably less favorable. (auth)

5650 Correlation of Activation Energies for Self-Diffusion in Cubic Metals. J. C. Fisher and R. E. Hoffman. SO-2001, July 1950. 11p.

Activation energies Q for self-diffusion in cubic metals appear to be determined largely by the heat of sublimation, L_s the atomic volume V, and the elastic constants, according to the relationship $Q = 0.325\ L_s + 0.216\ C_{44}\ V$, where C_{44} is the elastic constant relating shear strains and shear stresses. This relationship supports the idea that the diffusion process involves the creation of lattice vacancies and the motion of atoms into vacancies. (auth)

5651 An X-ray Study of the Stereochemistry of the Nucleosides. S. Furberg. Acta Chem. Scand. 4, No. 5, 751-61(1950).

Single crystals of cytidine, uridine, adenosine, and guanosine have been studied by x-ray diffraction methods. The complete crystal structure of cytidine has been determined by two-dimensional Fourier syntheses, showing directly that cytidine is cytosine-3-β-d-ribofuranoside. The planar pyrimidine ring and the nonplanar ribose ring are linked in such a way that they are nearly perpendicular to each other; the central bond N_3-C_1' lies in the plane of the pyrimidine ring. Preliminary investigations of the other three ribonucleosides, supported by other physical data, indicate that these molecules have a shape similar to that of cytidine, and it is considered likely that this holds also for the desoxyribonucleosides. (auth)

5652 Study of the Fischer-Tropsch Reaction Using Deuterium Gas. Sydney O. Thompson, John Turkevich, and A. P. Irsa. AECU-887, nd. 35p.

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A description is given of an apparatus for the production of deutero carbons from deuterium and carbon monoxide. The various deutero carbons and waxes were examined for their mass spectrum patterns and infrared spectra. (auth)

5653 A Study of the Interaction of Ethylene and Deuterium. John Turkevich, Donald O. Schissler, and Adolph P. Irsa. AECU-892, nd. 14p.

The interaction of ethylene and deuterium can take place by the additive reaction $C_2H_4 + D_2 \rightarrow C_2H_4D_2$, or by the exchange reaction $C_2H_4 + D_2 \rightarrow C_2H_3D + HD$. These reactions are studied in this report by means of mass spectrographic analyses of the various deutero ethylenes, deutero ethanes, and the hydrogen-deuterium gas during the catalytic conversion of ethylene into ethanes. The results obtained for the interaction of ethylene with two volumes of deuterium on a nickel wire at 90°C show that the exchange reaction proceeds more rapidly than the addition reaction, and that the concentration of light ethylene decreases exponentially, while that of the substituted ethylenes goes through a maximum before it finally reaches zero. A surprising result is the discovery of completely light ethane from the reaction of ethylene and deuterium. These results suggest that the ethylene hydrogenation is effected by the hydrogen that was previously on another ethylene molecule, and only indirectly by the hydrogen molecule. This point is being further investigated, and the mechanism formulation is being reserved until the kinetic investigations are completed.

5654 The Determination of Fluorine in Zirconium Metal. Phyllis C. Davis. ISC-83, May 10, 1950. 5p.

A procedure is described wherein microgram quantities of fluorine in zirconium metal are quantitatively determined by oxidizing the metal sample in a stream of moist oxygen in a platinum reaction tube. The hydrofluoric acid formed in the reaction is collected by condensing the water vapor and determined by a colorimetric titration with thorium nitrate using sodium alizarin sulfonate indicator. (auth)

5655 Spectroscopic Properties of Fluorocarbons and Fluorinated Hydrocarbons; Final Report. D. C. Smith, J. Rud Nielsen, L. H. Berryman, H. H. Claassen, and R. L. Hudson. Naval Research Laboratory. Report NRL-3567, Sept. 15, 1949. 183p.

Infrared spectra of 40 fluorinated compounds and Raman spectra of 25 compounds are presented. Vibrational assignments are proposed for $CH_2=CF_2$, $CF_2=CF_2$, $CF_2=CCl_2$, $CF_2=CFCl$, CH_3-CF_3, CH_3-CCl_3, $CF_2=CF-CF_3$, cyclic C_4F_8, and for 9 fluorinated aromatics. Application of spectral data to analysis, molecular structure, thermodynamic properties, and molecular forces is discussed. 92 references.

5656 Development of Zirconium Base Alloys. Sixth Quarterly Report (Progress Report No. 7) J. W. Pugh. SO-2501, July 5, 1950. 23p.

An illustrated description of a new automatic loading arc casting furnace is presented. The construction of a zirconium sponge degassing furnace, a high-temperature heat treating furnace, and high-temperature creep-rupture testing furnaces are described. Notes are made on physical properties and response to heat treatment of zirconium-chromium alloys observed thus far. (auth)

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5657 Adsorption of Gases on Solids. Final Report. E. L. Pace, Murray Goldstein, D. J. Sasmer, and E. L. Heric. Western Reserve University, Dec. 1, 1949. 11p. (AEC File No. NP-1439.)

The design and details of construction of a low-temperature adiabatic calorimeter for measurement of the thermodynamic properties of an adsorbate on a nonporous solid between the temperatures of 15 and 90°K are described. Adsorption isotherms of the methane-TiO_2 system in the temperature range 77 to 90°K are presented for concentrations extending to above the monolayer. (auth)

5658 Paramagnetic Susceptibilities of Solid Solutions of MnF_2 and ZnF_2. Lester Corliss, Yvette Delabarre, and Norman Elliott. AECU-903, nd. 10p.

The paramagnetic susceptibilities of solid solutions of MnF_2 and ZnF_2 have been measured as a function of temperature. The Curie-Weiss law $\chi = C/(T + \Delta)$ is obeyed by all the solutions examined over the temperature range 76 to 295°K. The constant Δ was found to be a linear function of the mole fraction of MnF_2. This behavior is consistent with the assumption that the magnetic interaction energy association with a given ion is proportional to the number of its paramagnetic neighbors. (auth)

5659 Stability of Metal Carbonyls. D. A. Pospekhov. J. Phys. Chem. U.S.S.R 21, 11-13(1947). (Translation AEC File No. NP-2163.)

A brief review of the literature on the stability of metal carbonyls is given followed by a discussion of the stability of polymers of carbonyls and of the possible existence of copper and silver carbonyls.

5560 The Thermal Neutron Scattering by Ammonium Chloride. Motoharu Kimura. Phys. Rev. 79, 544 (1950) Aug. 1 (Letter to the editor).

The temperature dependence of the neutron-scattering cross section of NH_4Cl was studied, in the range −70°C to room temperature, as a clue to the transformation at −30.8°C. A maximum scattering occurred at this temperature and is ascribed to a mutation between the ordered and the disordered states of the NH_4^+ ions rather than to lattice distortion.

5661 The Effect of X-irradiation on Cytochrome C. E. S. Guzman Barron, and Veronica Bonzell. ANL-4467, June 8, 1950. 23p.

Reduced cytochrome C is easily oxidized on irradiation with hard x-rays (200 kv) and the extent of oxidation is proportional to the dose of irradiation. The ionic yield is 0.55. The oxidation produced by 10,000 r is completely reversed on addition of a suitable reducing agent. This oxidation is produced only by the OH radicals given off on irradiation of water. H_2O_2 and O_2H radicals have no effect. On irradiation of ferricytochrome C in neutral, acid, and alkaline solutions with x-ray intensities of 50,000 and 100,000 r, it is found that cytochrome dissolved in acid solution is more susceptible to the destructive effect of ionizing radiations. On irradiation with 100,000 r in 0.005M HCl there is almost complete disappearance of the big Soret band of the porphyrin nucleus and of the band at 5300 A of ferricytochrome. (auth)

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5662 Effect of X-irradiation on the Hyaluronidase-Hyaluronic Acid System. III. The Nature of the Macromolecular Changes. Melvin D. Schoenberg, Robert E. Brooks, John J. Hall, and Herman Schneiderman. UCLA-83, Aug. 1, 1950. 19p.

X-irradiated solutions of hyaluronate show a marked degradation of the polysaccharide. The rate of enzymatic degradation of irradiated hyaluronate is decreased. It is proposed that the molecular-weight change is responsible for the altered rates. (auth)

5663 Chemical Effects of Ionizing Radiation in Some Gels. M. J. Day. Nature 166, 146-7(1950) July 22 (Letter to the editor).

In a search for a suitable system which would enable three-dimensional distributions of absorbed energy to be demonstrated, experiments with gels containing dyes which are reduced with change of color on irradiation are reported. Various phenomena have been observed, apparently bearing also on the biological action of ionizing radiation and on electron-capture processes in general.

5664 An Instrument for Internal Standard Flame Photometry and Its Application to the Determination of Calcium in the Rare Earths. Robert H. Heidel and Velmer A. Fassell. AECU-875, June 28, 1950. 14p.

Details are given for simple modifications of a laboratory monochromator so that selected internal-standard line pairs from flame spectra may be isolated and measured simultaneously with a multiplier-phototube differential photometer. The basic design is applicable to most spectrometers or spectrographs. An atomizing system with provisions for sample recycling and recovery is also described. This equipment has been applied to the determination of calcium in the rare earths in the concentration range 0.025 to 2.5%. Average deviation for a series of repeated determinations at various concentrations is about ±1.5%. 18 references. (auth)

5665 Solubility of the Rare Earth Oxalates and Complex Ion Formation in Oxalate Solution. II. Neodymium and Cerium(III). Carl E. Crouthamel and Don S. Martin, Jr. AECU-876, nd. 21p.

Radiochemical assays have been used to measure the solubilities of cerium and neodymium in buffered oxalate solutions. The data have permitted the calculations of equilibrium constants which satisfactorily describe the systems. These have been compared with those from earlier work on ytterbium. Neodymium was found to form the complex ion $Nd(C_2O_4)^+$ and $Nd(C_2O_4)_2^-$ with very nearly the same stability constants as ytterbium, but it had a minimum solubility of about 1.5×10^{-6} moles/liter compared to 3×10^{-5} moles/liter for ytterbium. Evidence was found for the formation of $Ce(C_2O_4)^+$, $Ce(C_2O_4)_2^-$, and $Ce(C_2O_4)_3^{-3}$. Cerium had a minimum solubility of about 1.7×10^{-6} moles/liter. (auth)

5666 Progress Report on the Separation of the Rare Earths by Ion-Exchange for the Period May 1, 1947, to May 1, 1949. F. H. Spedding. ISC-61, nd. 23p.

A progress report on the work accomplished since the previous progress report on separation of rare earths (ISC-4, May 1947) is presented. Section A, dealing with the separation of the light rare earths (cerium group), consists of ab-

stracts of reports ISC-39 and ISC-40 on the variables involved in the separation of samarium, neodymium, and praseodymium and the use of 0.1% citric acid - ammonium citrate solutions. Section B, gives details on the separation of the heavy rare earths (yttrium group). The main topics discussed include experimental column runs, equilibrium experiments, purification of National Bureau of Standards samples and experiments starting with ores. (auth)

5667 Data on the Preparation of Rare Earth Metal Silicides by Igneous Electrolysis. Maurice Dodero. Bull. soc. chim. France, 445(1950) May-June (in French).

A rare earth oxide is dissolved in a bath of molten calcium silicate, calcium fluoride, and calcium chloride in a carbon crucible, the temperature of the mixture being 1100°. The crucible acts as anode; aluminum lying on the surface of the bath is the cathode. When a current of 30 amp is passed through, an alloy of rare earth silicide and silicon forms on the cathode. The purification of the silicide from silicon is described.

5668 The Fractional Separation of Zirconium and Hafnium by Extraction with Trifluoroacetylacetone. Boyd G. Schultz and Edwin M. Larsen. J. Am. Chem. Soc. 72, 3610-14(1950) Aug.

In the extraction of a hydrochloric acid solution of zirconium and hafnium with a benzene solution of trifluoroacetylacetone, the extraction coefficients appeared to follow a fourth power dependence on the diketone activity, at constant hydrochloric acid concentration and constant initial metal ion concentration. Equilibrium constants calculated on the basis of monomeric ion species showed a decrease with increasing metal ion concentration. This observation was shown to be consistent with the idea that the zirconium and hafnium ions exist in equilibrium with nonextractable polymeric species even at moderate concentrations. The change in K values with increasing chloride ion concentration indicated that the hafnium-chloride complex was stronger than the corresponding zirconium ion pair. Zirconium was successfully separated from hafnium by extracting 0.2N hydrochloric acid solutions of zirconium and hafnium with a benzene solution of trifluoroacetylacetone. In two extractions, the mole % of hafnium in a zirconium-hafnium mixture was reduced from 1.56 to less than 0.1 to 0.05 with a 6.9% yield of the original zirconium, and, in six extractions, the mole % of hafnium in a zirconium-hafnium mixture was increased from 7.5 to 99.98 mole % with a 37.6% yield of the original hafnium. (auth)

5669 Production of Methanol-C^{14} by the Lithium Aluminum Hydride Process. R. F. Nystrom, W. J. Skraba, and R. G. Mansfield. ORNL-395, Sept. 30, 1949. 17p.

Basically, the process consists of introducing carbon dioxide into a solution of lithium aluminum hydride in diethylcarbitol, treating the resulting product with n-butylcarbitol and removing the liberated methanol by distillation. In theory, methanol is the only volatile material present in the system and should therefore be readily separable in pure form by a simple distillation. In practice, however, difficulties arise due to the presence of traces of diethyl ether which are present in commercial lithium aluminum hydride and also

because a clean separation is not too easily achieved. Because of these factors, the product initially obtained from the reaction mixture, is not pure methanol but a mixture containing substantial amounts of diethylcarbitol, together with traces of diethyl ether. A more elaborate process has been designed to remove these impurities.

5670 The Biosynthesis of Carbon^{14}-Labeled Compounds. I. The Chromatographic Separation of Glucose and Fructose. G. R. Noggle and René A. Bolomey. ORNL-787, Aug. 17, 1950. 27p.

The general method and apparatus used in the introduction of C^{14} into plants by photosynthesis in a $C^{14}O_2$ atmosphere is described. The radiosugars are extracted from the plants with boiling 80% ethanol. After removal of the alcohol and precipitation of the proteins, the sugar solution is deionized by passage through cation- and anion-exchange resins. The deionized sugar solution is then inverted with acid, the acid removed by anion exchange, the solution concentrated in vacuum, and the glucose and fructose separated by passing the solution through a column of Magnesol (a hydrated magnesium acid silicate) using 95% ethanol as eluant. Pure radioglucose and radiofructose may be crystallized from the column eluates.

5671 Gallium Citrate and Radio-gallium (Ga^{72}) Citrate. H. C. Dudley. J. Am. Chem. Soc. 72, 2822-3(1950) Aug. (New Compounds).

In studies of the physiological characteristics of gallium and radiogallium, the citrate was prepared and found superior in many respects to all other compounds tried, including gallium lactate. Freshly precipitated gelatinous gallium hydroxide was treated with citric acid in the ratio of 1 mole gallium to 1.2 moles citric acid. The mixture was partially evaporated and poured into 10 volumes of cold ethanol. This precipitated the gallium citrate and dissolved the excess citric acid. The product obtained without further purification contained 25 to 26% gallium, was completely water soluble, was stable at pH 7 to 8, and was suitable as a water solution (pH 7.4) for subcutaneous or intramuscular injection at concentrations of 20 mg Ga/cc. To prepare radiogallium citrate, 5cc of $Ga(NO_3)_3$ solution was bombarded in a pile after which 2 cc of 20% citric acid was added. The solution was neutralized with sodium hydroxide. A yield of 1 mc/cc of solution was obtained. Safety precautions employed in handling the radiogallium are given.

5672 A Synthesis of Adenine Labelled with ^{14}C. V. M. Clark and H. M. Kalckar. J. Chem. Soc., 1029-30 (1950) Apr.

With 4-formylmorpholine as a solvent, adenine hydrochloride labeled in the 8 position has been prepared by cyclization of the correspondingly labeled 4:6-diamino-5-formamidopyrimidine hydrochloride, which was obtained by formylation of 4:5:6-triaminopyrimidine hydrochloride with C^{14}-labeled formic acid.

5673 Very Pure Radioactive Orthophosphate for Bacteriology. Jean Mérimis and Pierre Süe. Bull. soc. chim. France, 485-6(1950) May-June (in French).

Irradiated red phosphorus was transformed into disodium orthophosphate by treating it with warm oxygenated water. Copper impurities were removed by electrolysis.

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5674 The Exchange Reaction between Ferrous and Ferric Ions in Perchloric acid Solutions. Richard W. Dodson. AECU-907, nd. 5p.

In an attempt to resolve the discrepancies regarding the rate of electron transfer exchange between ferrous and ferric ions, a quantitative chemical separation has been devised which leads to only a small amount of induced exchange. The results to date indicate that the reaction is a rapid one but that its rate can be measured. The separation is based on formation of the very stable complex between α-α'-dipyridyl and ferrous ion. Solutions of the reactants are mixed with rapid and continued stirring, and at the desired time the reaction is quenched by adding in rapid succession an excess of a dilute solution of dipyridyl followed by sufficient sodium acetate solution to bring the pH to about 5. Subsequently, the ferric iron is precipitated by addition of ammonium hydroxide. The iron in either or both fractions is finally converted to ferric 8-hydroxyquinolate and counted as such. The tracer used in the experiments here reported was Fe^{55} and was initially in the ferric species. The results indicate that catalysis by traces of chloride was not an important factor in determining the rate. The change of half-time with iron concentration shows the reaction to be second order, presumably first order in ferric and in ferrous iron, in which case the rate constant in 0.4 f perchloric acid is 16 $mole^{-1}$ l sec^{-1} at 23°C.

5675 The Effect of Treatment of Glass with Solutions of Stannous Chloride, Stannic Chloride, and Other Salts on Its Sorption of Silver from Aqueous Solution. Merle E. Jones and John E. Willard. AECU-910, nd. 15p.

The sorption of silver on soda-lime-silica glass surfaces immersed in aqueous silver nitrate solution is increased by a factor of two or more by pretreatment of the surfaces with $SnCl_2$ or $SnCl_4$ solutions but is not significantly affected by pretreatment with solutions of other salts tested. The tin solutions are effective at high acid concentrations but alkaline (stannite) solutions are not effective. The tests w were made with the aid of radioactive silver (Ag^{110}), using 1 sq in. glass plates as the test specimen. (auth)

5676 The Enzymatic Formation of Citric Acid Studied with C^{14}-Labeled Oxalacetate. Victor Lorber, M. F. Utter, Harry Rudney, and Margaret Cook. J. Biol. Chem. 185, 689-99(1950) Aug.

The distribution of activity in citrate formed enzymatically from C^{14}-labeled oxalacetate ($C^{14}OOH.CH_2.CO.COOH$) and non isotopic acetate has been studied. Chemical degradation and enzymatic oxidation to α ketoglutarate indicate reaction mechanisms and metabolic behavior in accord with the proposal of Ogston [Nature 162, 963(1948)] that citrate in an enzyme-substrate complex behaves as an asymmetric molecule. Citrate is suggested rather than cis-aconitate or isocitrate as the initial condensation product in the tricarboxylic acid cycle. Evidence is given for the irreversibility of the citrate-forming reaction.

5677 Mechanism of Alcoholic Fermentation. The Fermentation of Glucose-1-C^{14}. D. E. Koshland, Jr., and F. H. Westheimer. J. Am. Chem. Soc. 72, 3383-8 (1950) Aug.

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Glucose-1-C^{14} has been prepared by a modified Fischer-Kiliani synthesis from d(−)-arabinose and $HC^{14}N$. An overall radiochemical yield of 10% was obtained. A method is described for the degradation of isotopically labeled ethyl alcohol to determine quantitatively the relative amounts of radioactivity in the CH_3 and $-CH_2OH$ groups. Glucose-1-C^{14} has been fermented by yeast and the distribution of radioactivity in the products ascertained. About 95% of the total radioactivity fermented appeared in the methyl group of the alcohol obtained. This result gives quantitative support to the currently accepted mechanism for the alcoholic fermentation. About 3% of the radioactivity of glucose-1-C^{14} appeared in the carbon dioxide produced in the fermentation. Several alternative explanations of this deviation from the fermentation mechanism are discussed. 15 references. (auth)

5678 Oxygen Exchange between Nitrates and Water. Ralph Klein and Robert A. Friedel. J. Am. Chem. Soc. 72, 3810-11(1950) Aug. (Note)

Oxygen exchange is shown not to occur between cellulose nitrate and O^{18}-enriched H_2O. In a 40% HNO_3 solution at 30°C, an acid-water oxygen exchange with a half-life of the order of 30 min is demonstrated and a pH dependence is suggested. This dependence and the lack of exchange between the nonionizable cellulose nitrate and H_2O suggest that the mechanism of oxygen exchange between nitrates and water involves interaction of the ions NO_3^- and H_3O^+.

5679 A Synthesis of Cyanamide from Barium Carbonate Applicable to Use of Isotopic Carbon. Susanne von Schuching and Frederick W. Barnes, Jr. J. Am. Chem. Soc. 72, 3817-8(1950) Aug. (Notes)

It was found that barium carbonate reacts readily with ammonia in the presence of sodium azide to give cyanamide, the reaction being easily carried out in one step with greater than 94% yield based on carbon. This contrasts with more difficult conditions of reaction when no sodium azide is used. The experimental evidence applies to barium carbonate of normal isotope content. The reaction also has been used in the synthesis of cyanamide from 124 mg of barium carbonate of which the carbon included 1 mc of C^{14}. The technique of the condensation was that described by Adamson (J. Am. Chem. Soc. 69, 2564(1947)), except that anhydrous ammonia (passed over potassium hydroxide) was passed briskly into the open end of the test tube which contained 200 mg of isotopic barium carbonate and 4 g of sodium azide.

5680 The Heat of Reaction of Americium Metal with 1.5M Hydrochloric Acid and a Note on the Heats of Formation of $La^{+3}(aq)$ and $Pr^{+3}(aq)$. H. R. Lohr and B. B. Cunningham. AECD-2902, July 18, 1950, Decl. Aug. 21, 1950. 15p.

The heat of reaction of americium metal with 1.5M HCl has been measured to be -162.3 ± 2.7 kcal/mole at 25°C. The heats of formation at the same temperature of $Am^{+3}(aq)$, $AmO_2(c)$, and $AmCl_3(c)$ are calculated to be -163.2 ± 2.7, -244.4 ± 3, and -251.3 ± 2.7 kcal $mole^{-1}$, respectively. The E value for the couple $Am(c) = Am^{+3}(aq) + 3\ e^-$ uncorrected for the activity coefficient of Am^{+3} is estimated to be 2.36 ± 0.04 volts. Preliminary measurements suggest that the

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heats of formation of $La^{+3}(aq)$ and $Pr^{+3}(aq)$ are -167.0 ± 1.4 and -165.3 ± 0.9 kcal $mole^{-1}$, respectively. (auth)

5681 Some Chemical and Physical Properties of Uranium Peroxide. George W. Watt, Siegried L. Achorn, and Jack L. Marley. J. Am. Chem. Soc. 72, 3341-3(1950) Aug.

Two different crystalline forms of uranium peroxide 2-hydrate are formed by the reaction between excess uranyl nitrate and hydrogen peroxide, and between uranyl nitrate and excess hydrogen peroxide. The uranium-uranium distance is the same in both types of crystal. The precipitation of uranium as the peroxide 2-hydrate is substantially quantitative at pH 2.5 and 3.5. The product obtained at an initial pH of 4.5 (following addition of ammonium hydroxide) consists of uranium peroxide 2-hydrate, ammonium diuranate, and at least one other crystalline solid. At pH ≤ 1, uranium peroxide 2-hydrate and at least one additional crystalline product are formed. Uranium peroxide 2-hydrate is dissolved without gas evolution by aqueous solutions of sulfites to form an intensely yellow solution and (under appropriate conditions of concentration) a similarly colored solid which is apparently a mixture. The soluble product responsible for the color of the solution has been shown to consist of uranyl sulfite, which has not been reported previously. 14 references. (auth)

ENGINEERING

5682 Pumping Speed of Oil Diffusion Pumps for Hydrogen and Air. Harry Reese, Jr. ORNL-764, Aug. 11, 1950. 17p.

When maximum pumping speed for hydrogen is required the pumps should be operated with minimum possible forepressure but the heater voltage should not necessarily be as high as possible. There is usually some optimum value which should be found experimentally. A brief description of each pump tested is given and graphical data are included.

5683 Use of Radioisotopes in British Industry, 1949-1950. K. Fearnside. Nucleonics 7, No. 2, 84-7(1950) Aug.

A short account is given of the industrial uses of radioisotopes, dividing the uses into the following categories: (1) tracer experiments (oil on nylon fibers, uneven dyeing of woolen cloth, bearing wear); (2) thickness measurements; and (3) static elimination and other problems involving the ionization of gases.

MINERALOGY, METALLURGY, AND CERAMICS

5684 The Measurement of Paleotemperatures; Scientific Report to the Geological Society of America, the American Petroleum Institute, and the Office of Naval Research. Harold C. Urey. Feb. 27, 1950. 146p. (AEC File No. NP-1472.)

Measurement of the O^{16}-O^{18} isotopic ratio in carbonates deposited by plant and animal life has been shown to be a satisfactory method for determining the temperature at the time of deposition. The isotopic temperature scale is linear and accurate to $\pm 1°C$. Paleotemperature measurements of the Upper Cretaceous demonstrate that isotopic composition is retained over long periods of time. Fossil Jurassic mollusk shells have preserved a record of seasonal temperature variations for more than 100,000,000 years. The precision mass spectrometer used in this investigation is described. Related investigations reported include the demonstration of an approximately linear relation between salinity of water and O^{18} content of deposits, theoretical calculations of temperature-variation effects in O isotope fractionation, and progress reports on a "phosphate-carbonate thermometer," a continuous method of measuring seasonal paleotemperature variations, and the O isotope abundance of silicate rocks.

MINERALOGY, METALLURGY, AND CERAMICS

5685 Directional Tensile Properties of Sheet Zirconium. A. D. Schwope and S. J. Stockett. BMI-T-32, July 1, 1950. 12p.

Tensile tests on specimens of sheet zirconium showed the modulus of elasticity to be 13.9×10^6 psi parallel to the rolling direction, 14.0 to 14.2×10^6 psi at 90 deg to the rolling direction, and 13.6×10^6 psi at 45 deg to the rolling direction. While these results indicate some anisotropy, the effect is not large enough to warrant much concern at present. The ultimate tensile strength was 87,000 to 87,400 psi for the longitudinal specimens and 76,000 to 81,000 psi for the transverse and 45 deg specimens. Poisson's ratio, as determined from longitudinal and lateral strains during the tensile tests, was found to be between 0.32 and 0.35. (auth)

5686 Experiments on the Corrosion of Light Metals by Corrosive Waters. Werner Mialki, and Karl Popper. Aluminum 23, 583-90(1941). (Translation. AEC File No. NP-2073.)

Continuing previous work by one of the authors, further investigations were carried out on the behavior of aluminum and aluminum alloys with and without surface protection in various corrosion baths in order to throw further light on their behavior under the conditions existing in tap-water. It was confirmed that pitting is quite serious in the CO_2 bath, but the number of corrosion spots and the decrease in tensile strength is lower in this case than in the oxygen bath. The corrosion behavior of aluminum alloys in the carnonic acid baths does not give any unequivocal picture of its behavior toward tap water. The experiments have shown that hardened Al-Mg-Si alloy has the greatest tensile strength and also has the best corrosion behavior toward flowing waters under adverse conditions. (auth)

5687 Monthly Report on Graphite. R. F. Geller. NEPA-965, Mar. 25, 1949. 2p.

Results of tests to determine the suitability of using platinum in the presence of graphite and silica at elevated temperatures, and either in a vacuum of 100 μ Hg, or less, or in a He atmosphere at slightly above atmospheric pressure, are reported. At 1800°F no deleterious effects were noted on platinum gauge surfaces or on Pt-PtRh thermocouple wires. At 2500°F, however, the Pt surfaces showed advanced crystallization and, where the wire was in contact with the graphite, the Pt had the appearance of having been fused and of having recrystallized into very coarse crystals. (auth)

5688 The Promise of the Newer Metals for Engineering and Chemical Applications, and Some Problems Associated with Their Production. G. B. O'Malley. Roy. Australian Chem. Inst. J. & Proc. 17, 218-19 (1950) June.

MINERALOGY, METALLURGY, AND CERAMICS

A summary of the lecture is reproduced below in its entirety.

The specific metals considered were titanium, zirconium, beryllium, tantalum, lithium, and uranium. Mr. O'Malley prefaced his discussion of these with a reference to the Periodic Table. He showed how the interatomic distances in the crystal structures of the various metals affect their ability to alloy with one another. Metals like titanium, abundant in the earth's crust, may be available in quantity in the future. Others like beryllium, rare and hard to isolate, will never have more than a limited availability. Titanium metal has both good structural and chemical properties, an example of the latter being its high resistance to sea-water attack. Its widespread use may be expected as soon as smelting difficulties connected with its high-temperature affinity for some common gases and the ability of the molten metal to permeate all refractories easily have been overcome. Some titanium alloys have physical properties equal to those of the best steels. The strength-weight ratios of the metal and some of the alloys may reach values unapproached by other structural materials, and their use in aircraft, particularly in the turbine vanes of jet engines, is expected to expand considerably in the next five years. The metallurgy of zirconium is similar to that of titanium. It is at present mostly used in the unalloyed form. It is of importance for its chemical durability, and for its workability. Beryllium is best prepared by chloride metallurgy, and its practical isolation has presented some extremely difficult problems. The metal has a low specific gravity (1.85), but it is of principal interest in alloys such as beryllium-copper. Tantalum also involves a complicated preparation, and it is used in practice because it has high chemical resistance (to hydrogen chloride, for instance) and it is one of the most workable of metals. It has unique uses in surgery. Lithium is one of the softest metals, with the low specific gravity of 0.53. Its greatest promise is in alloys with "stiff" metals like magnesium, where a compromise between strength and workability is possible. Some magnesium-lithium aircraft alloys have a specific gravity of 1.4. Such alloys in sheet form have unsurpassed buckling resistance per unit weight. Various uranium alloys have been investigated, such as those with aluminum, tungsten, and tantalum. (auth)

5689 On the Equilibrium of the Radioactive Elements in the Hydrosphere. V. A Simple Method for Distinguishing Uranium and Thorium in Radioactive Minerals. Kazuo Kuroda. Bull. Chem. Soc. Japan 22, No. 4, 149-50(1949).

It was found that uranium and thorium in radioactive minerals are easily distinguished by measuring the radioactivity of radium emanation and thorium emanation in the minerals with an I. M. fontactoscope.

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5690 Technical Report No. 1: I. Calculation of the Size Distribution of Aerosol Particles from Tranquil Settling Data. II. Calculation of the Mass Median Diameter of an Aerosol from Stirred Settling Data. W. E. Ranz. SO-1000, Apr. 30, 1950. 41p.

The mathematical analysis of tranquil settling data to obtain information on the size distribution of aerosol particles of uniform density is tabulated conveniently in terms of the sampling methods available. An analysis of density measurements gives directly cumulative number, surface, or weight distributions. A graphical differentiation will give the distribution function. Analysis of collection measurements gives cumulative distributions after one graphical differentiation and the distribution function after two differentiations. Each differentiation, however, magnifies the errors in the previous experimental measurement or mathematical operation and shortens the range of particle size over which the analysis can be made. The analysis of stirred settling data is also discussed and shown to be a convenient method for determining median diameters if a functional form for the size distribution is assumed. Practical and experimental limitations of the settling method are discussed. The analysis of settling data is shown to be a convenient method of obtaining a median size for particles of unit density with effective diameters between 1 and 100 μ. (auth)

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5691 On a Difference Equation Method in Cosmic Ray Shower Theory. W. T. Scott. AECU-881, May 24, 1950. 12p.

The recent results of Snyder (Phys. Rev. 76, 1563(1949)) and Bhabba-Chakrabarty (Phys. Rev. 74, 1352(1948)) for the cascade theory of cosmic ray showers are shown to be derivable from a general approach involving the use of the Laplace and Mellin transforms, and a general and powerful method, due to Snyder (Phys. Rev. 75, 906(1949)) for solving the resulting difference equations. Boundary conditions are introduced in a natural and automatic way, and the accuracy of the solution is limited by the possible ways of evaluating the resulting triple-complex integral. (auth)

5692 Latitude Effects for Stars. I. Production Rates and Prong Distributions. E. O. Salant, J. Hornbostel, C. B. Fisk, and J. E. Smith. AECU-891, May 17, 1950. 5p.

Fifteen hundred stars in minimum ionization emulsions (200-300 μ Ilford G5, Eastman NTB3, and laminated emulsions), flown to 15 g/cm^2 altitude at 31 and 57 deg geomagnetic north were analyzed with respect to the number of dense prongs, proton induced stars, and stars without minimum tracks in the hemisphere above.

5693 Improved Calculations on Cascade Shower Theory. Ira Bernstein. AECU-899, May 1950. 30p.

The diffusion equations of cascade shower theory are solved by means of a perturbation method. The first approximation is taken to be that solution obtained when the so-called completely screened cross sections are used for the elementary processes of bremsstrahlung and pair production. The correction to this is then calculated using more refined approximations to the Bethe-Heitler cross sections. The results, which lend themselves to accurate numerical work only in the case of light elements and high incident energies, indicate that (1) the shower maximum is decreased in height and slightly shifted to greater depths and (2) there is a decrease in the average number of electrons present at small absorber depths and a correspondingly larger number at large depths. The magnitude of the effect is larger than had been previously assumed. Numerical results are given so that the correction to the solution under the assumption of completely screened cross sections can be readily calcu-

lated for all light elements when the incident particle is either a single photon or a single electron. (auth)

5694 Latitude Effects for Stars. II. Shower Particles. E. O. Salant, J. Hornbostel, C. B. Fisk, and J. E. Smith. AECU-905, May 17, 1950. 6p.

Regarding the study of latitude effects, this paper treats shower particles in p-stars. At each latitude the multiplicity increases with star size indicating plural production of showers. For small stars (light nuclei), mean multiplicities do not vary with incident proton energy; such energy-insensitivity would be expected if a single relativistic particle were produced in a nucleon-nucleon encounter. Multiple production is not excluded, but is rare. The higher proton energies raise the multiplicities of large stars (heavy nuclei). Increase of energy of the incident proton can produce more relativistic particles by cascade within large nuclei, and so, in view of the energy-independence of light-nuclei multiplicities, the latitude effect for heavy nuclei is interpreted as the result of plural collisions. The 1 to 8 Bev protons give the same multiplicity for all star sizes, which implies that they produce their maximum number of shower particles in a 12 to 16-nucleon system.

5695 Emulsion Studies of Cosmic-Ray Stars Produced in Metal Foils. Ian Barbour and Lawrence Greene. Phys. Rev. 79, 406-7(1950) July 15 (Letter to the editor).

Foils of various metals were sandwiched between pairs of Ilford G-5 emulsions placed face-to-face so that, after development, tracks could be observed in the emulsions and those originating in disintegrations of foil nuclei could be projected back to common centers outside the emulsion. Cosmic-ray induced disintegrations were studied to determine the dependence of the star-production cross section on atomic weight, and to observe the configurations typical of various target nuclei. Analysis of the data indicates a maximum at about 8 prongs per star for Au, and 6 for Sn, whereas for Cu and emulsion it occurs at smaller values.

5696 The Extension of the Theory of the Compton Effect to Mesic Fields. Gérard Petiau. Compt. rend. 231, 119-22(1950) July 10 (in French).

Generalizing the Compton effect, the author calculates the diffusion cross sections for processes in which a neutral meson of a given tensorial type is absorbed by a Dirac particle of spin ½, while a second meson, not necessarily of the same tensorial type as the first, is emitted. (auth)

5697 The Extraordinary Increase of Cosmic-Ray Intensity on November 19, 1949. Scott E. Forbush, Thomas B. Stinchcomb, and Marcel Schein. Phys. Rev. 79, 501-4(1950) Aug. 1.

Four sudden increases in cosmic-ray intensity associated with solar flares or chromospheric eruptions have so far been observed during more than a decade of continuous registration of cosmic-ray intensity. The last and largest of these increases occurred on November 19, 1949, when such an effect was recorded for the first time at a mountain station at Climax, Colorado. Here the intensity increased to about 200% above normal in half an hour. At the sea-level station at Cheltenham, Maryland, the increase was about 43%. No increase occurred at the equator. From the

gain in the effect with altitude and latitude, it is concluded that the increase was due to the nucleonic component produced by relatively low-energy primary charged particles probably accelerated by some solar mechanism.

5698 A Large Fluctuation in the Rate of Production of Nuclear Disintegrations Following a Solar Flare. J. J. Lord, A. W. Elston, and Marcel Schein. Phys. Rev. 79, 540-1(1950) Aug. 1 (Letter to the editor).

Emulsions carried by balloon to 95,000 ft about 23 hr after a solar flare showed an increase of 50% over the normal number of nuclear disintegrations. The unusually large latitude dependence of such increases indicates that they must be due predominantly to low-energy charged primary particles. This would also account for absence of effect (< 2% increase) at sea level.

5699 Magnetic Cloud-Chamber Analysis of Cosmic Rays at 3.4 Kilometers. Charles E. Miller, Joseph E. Henderson, David S. Potter, Jay Todd, Jr., and A. William Wotring. Phys. Rev. 79, 459-66(1950) Aug. 1.

The momentum spectrum of mesons (and some protons) at 3.4 km shows a distribution closely similar to that found for mesons at sea level. Contrary to previously published reports, no appreciable increase in the number of low energy mesons, relative to that at sea level, is found. Particles so selected as to eliminate electrons show a positive to negative ratio of 1.5 ± 0.05 as compared to reported values of about 1.3 at sea level. This confirms previous reports of an increase in this ratio with altitude. However, it is shown that the increase in positive excess is due in part to a greater number of protons at higher altitudes, and it is suggested that the entire increase may be thus accounted for, the positive excess of mesons remaining constant with altitude. Some estimate has been made of the abundance of protons at 3.4 kilometers. (auth)

5700 A Measure of the Energy of Disintegration of Be^8 by an Examination of Certain Branches of Cosmic Stars. Jean Crussard. Compt. rend. 231, 141-3 (1950) July 10 (in French).

Neighboring tracks of α particles in cosmic-ray stars are attributed to the disintegration of Be^8 with a mean life of 10^{-16} sec. By measuring the angles and paths of the α particles in the emulsion, the energy Q of the reaction $Be^8 \rightarrow 2He^4 + Q$ is estimated to be 89 ± 9 kev. The emulsions were exposed at an altitude of 20,000 to 30,000 m.

5701 The Nature of the Neutral Particle Emitted in the Decay of the π Meson. C. O'Ceallaigh. Phil. Mag. 41, 838-48(1950) Aug.

In order that momentum and energy be conserved in the process of π-μ- decay at rest, it is necessary to assume the emission of a single additional nonionizing particle in a direction opposite to the initial line of motion of the μ meson. There exists strong experimental evidence for the conclusion that the neutral particle has small or negligible rest mass. Hence, one may suppose that it is either (a) some light neutral particle possibly identical with the neutrino of β decay, or (b) a photon. Some 250 suitable cases of π-μ- decay in Ilford G5 Nuclear Research plates have been examined with a view to testing the hypothesis (b). A careful

search has been made in the requisite direction, for associated pairs of electrons. In a total scan-length of 38 cm no such case was observed. Statistical analysis shows that, if a photon were emitted, the probability that it would fail to produce a pair under the conditions of the experiment was 4×10^{-3}. Since this result would appear to exclude the possibility of photon emission, it is inferred that the π-meson normally decays in accordance with (a). It is shown that the present experiment has much in common with those devised to demonstrate the existence of the neutrino of β decay. 23 references. (auth)

5702 On the Decay of Heavy Mesons. II. Case of Symmetrical Interaction. Seibun Sasaki, Sadao Ôneda, and Shoji Ozaki. Progress Theoret. Phys. 5, 25-41 (1950) Jan.-Feb.

The following processes involving the τ-meson having a mass of 700 to 1000 m_e are treated here: (1) $\tau^{\pm} \rightarrow \pi^{\pm} + \pi^0$; (2) $\tau^0 \rightarrow \pi^+ + \pi^-$; (3) $\tau^{\pm} \rightarrow \pi^{\pm} + \tau^0$; (4) $\tau^0 \rightarrow \pi^0 + \gamma$. Constructing the equation of motion for the process in which a heavy meson decays into lighter ones via nucleons, the decay lifetime of a τ meson into a π meson is calculated, and the selection rule for possible transition processes is investigated. Next, the equivalence between two different interaction forms of scalar and pseudoscalar mesons are studied. Further, it is shown how the regulator proposed by Pauli and Villars (Rev. Mod. Phys. 21, 434(1949)) for the divergence, nongauge covariance, and the equivalence theorum is used. The calculations are performed using the Tomonaga-Schwinger formalism.

5703 The Origin of Cosmic Rays. Edwin M. McMillan. Phys. Rev. 79, 498-501(1950) Aug. 1.

The original idea of Menzel and Salisbury (Nucleonics 2, No. 4, 67(1948)) concerning the origin of cosmic rays has been extended and some of its possible consequences have been worked out in more detail. It is concluded that low frequency electromagnetic waves (a few cycles per second) may exist in limited regions near the outer edge of the solar corona, and can accelerate ions to cosmic-ray energies. An attempt is made to explain both the "ordinary" cosmic rays and the intensity increases following solar flares in terms of the action of these waves. (auth)

5704 The Origin of Single Cosmic Ray Protons. S. Lattimore. Phil. Mag. 41, 819-25(1950) Aug.

The frequency of production, and the angular and energy distributions of single cosmic ray protons produced in photographic emulsions exposed at 3650 m are given. It is shown that, after corrections for protons emitted from stars have been made, the results agree with those given in a previous paper by the author (Phil. Mag. 40, 394(1949)). The rates of production of fast protons in paraffin wax, carbon, aluminum, and lead are deduced from measurements of the number of protons observed to cross 100 μ C.2 emulsions surrounded completely by these materials. From the results for paraffin wax and carbon, the rate of production in hydrogen is also deduced. (auth)

5705 The Shape of the Rossi Curve. W. Bothe and H. Thurn. Phys. Rev. 79, 544-5(1950) Aug. 1 (Letter to the editor).

Using coincidence counter trays above and below various thicknesses of lead under a concrete ceiling, the authors obtained Rossi curves displaying three maxima. It was found that, by the proper choice of conditions for shower production, each of the maxima could be isolated from the others. The first is ascribed to cascade showers from the ceiling enhanced in the lead, the second to hard narrow showers of mesons produced by single ionizing particles, probably μ mesons, and the third to nonionizing radiation which may prove to be neutral mesons.

5706 A New High-Temperature Calorimeter. Raleigh L. McKisson and LeRoy A. Bromley. UCRL-688, May 1, 1950. 34p.

A high-temperature calorimeter, designed for use in the temperature interval 600 to 1500°K, is described. This calorimeter consists of a thermostat of molten tin surrounding a cavity in which the sample is placed. The calorimeter is resistance-heated and control of the thermostat temperature to ±0.5°C is effected by means of a modified "single-speed floating" control. Equations which allow calculation of the data are derived and their use explained. (auth)

5707 Electronic Instrumentation in Atomic Research. Denis Taylor. Engineering 169, 631-4, 644-5(1950) June 2 and 9.

A wide variety of electronic instruments have been designed in connection with the British atomic energy program. This paper gives an account of the design and purpose of these instruments. Electronically, many of the developments are straight forward and involve well-known circuits. The novelty is, for the most part, in the application. The following sections of the program are discussed: the safety and control circuits associated with an atomic pile, radioactivity assay instruments, automatic equipment, effluent activity measuring apparatus, and radiation monitoring and surveying instruments.

5708 Million-volt Beryllium-window X-ray Equipment for Biophysical and Biochemical Research. Wm. T. Ham, Jr. and E. Dale Trout. Radiology 55, 257-70(1950) Aug.

Investigations are reported on the physical characteristics of the x-ray beam emitted by a million-volt Be-window tube, at distances of 15 to 150 cm. Topics included are the radiation intensity pattern, β-particle component, dosage-rate distribution, and absorption in lead and polystyrene. Measurements were made of dosage rate by water absorption and by the use of bakelite and nylon ionization chambers.

5709 The Vapor Pressure, Critical Point, Heat of Vaporization, and Entropy of Liquid He^3. B. M. Abraham, D. W. Osborne, and B. Weinstock. ANL-4470, June 8, 1950. 20p.

The vapor pressure of pure liquid He^3 has been measured from 1.025 to 3.35°K, and the data shown to be accurately represented by the equation

$$\log_{10} P_{mm} = -0.97796/T + 2.5 \log_{10} T + 0.000302\, T^3 + 1.91594$$

The normal boiling point is 3.195 ± 0.001°K. The critical temperature and pressure have been determined to be 3.35 0.02°K and 890 ± 20 mm Hg, respectively. The calculated entropy of liquid He^3, excluding the nuclear-spin entropy, is 0.75 ± 0.1 cal deg^{-1} $mole^{-1}$ at 1°K, and the extrapolated value at 0°K is 0.42 ± 0.1 cal deg^{-1} $mole^{-1}$. This extrapolated value of the entropy suggests that below 1°K there

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is either a triple point or an anomaly in the heat capacity. The calculated heat of vaporization has a maximum value of 11.4 ± 0.4 cal mole^{-1} at 2.1°K, and the extrapolated value at 0°K is 4.47 cal mole^{-1}. (auth)

5710 Bibliography of Unclassified Reports and Published Literature on Tritium. Atomic Energy Research Establishment. AERE-Inf/Bib-65. May 11, 1950. 21p.

References on tritium occurrence, abundance, separation, experimental techniques, nuclear reactions, tracer applications, and miscellaneous references have been listed. 196 entries.

5711 Some Properties of He^3 Solution in He^4. B. N. Eselson and B. G. Lazarev. Doklady Akad. Nauk S.S.S.R. 72, 265-7(1950) Mar. (Translation. AEC File No. NP-2159.)

In the present article the authors give the results of their work toward the development of effective methods for enrichment in light isotopes. They also discuss the dependence of the temperature of the Lambda transition (He I into He II) on the concentration of He^3, and, in particular, on the spreading of He II along a capillary tube filament in He^3-He^4 mixtures. The description of the method of enrichment will be reported later. They mention here that it was first enriched by a factor of 10^3 by using the thermomechanical effect; and then by a factor 2×10^2 in the fractional column. The degree of enrichment was determined not by the limiting ability of this method, but rather by the necessity of obtaining quantities of about 20 cm^3. The mixtures with which the measurements were done contained up to 1.5% of He^3. The measurement of concentration was carried out by means of comparison of vapor pressure over the mixture and over He^4 under the assumption of the correctness of Raoult's law for these concentrations, and by using the data on the vapor pressure of pure He^3. 12 references. (auth)

5712 Isolation of Neon Isotope Ne^{20} of 99.95% Purity in a Separation Column. Klaus Clusius and Max Huber. Experientia 6, 262-3(1950) July 15 (in German).

From 6.65 liters of ordinary neon, 3.5 liters of helium free Ne^{20} with an isotopic purity of 99.95% were obtained in a thermal diffusion column of 5 units, each 2.85 m in length. The so-called "spectroscopically" pure neon of trade quality, delivered in glass tubes, contained 1.9% helium and about 0.5% nitrogen which could be easily detected and separated from the crude neon during the process.

5713 Application of the Microwave Mass Spectrograph to the Isotopic Analysis of Carbon in Cyanogen Chloride. H. W. Morgan, G. W. Keilholtz, William V. Smith, and A. L. Southern. Y-621, June 19, 1950. 11p.

A microwave mass spectrograph has been applied to the analysis of C^{13} in cyanogen chloride. The calibration curve and precision obtained are described for the range 1.1 to 10% C^{13}. The mass spectrograph unit is shown to be suitable for nitrogen and carbon isotopic analysis. (auth)

5714 A Redetermination of the Relative Abundances of the Isotopes of Neon, Krypton, Rubidium, Xenon, and Mercury. Alfred O. Nier. Phys. Rev. 79, 450-4(1950) Aug. 1.

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A careful redetermination of isotopic abundance ratios in neon, krypton, rubidium, xenon, and mercury has been made. The mass spectrometer employed was calibrated for mass discriminative effects with a synthetic argon isotope mixture made from essentially pure samples of A^{36} and A^{40}. The present results together with those obtained from an earlier study on carbon, nitrogen, oxygen, argon, and potassium enable one to use the several elements investigated as substandards for calibrating mass spectrometers for mass discriminative effects in other instances. (auth)

5715 Approximate Determination of Total Cross Sections from Differential Cross sections. T. Teichmann. Princeton University Technical Report No. II, nd. 8p. (AEC File No. NP-1661.)

A short discussion is given of the approximate determination of total cross sections from differential cross sections, in terms of sums of the type

$$\sum_{j=1}^{n} A_j \sigma(\theta_j) \simeq \int_0^{\pi} \sigma(\theta) \sin \theta d\theta$$

The ordinary, Gauss, and Tchebycheff approximating sums are described, the latter yielding one of the usual formulas for approximating such integrals. Formulas are derived for determining the A_j so as to obtain an approximation good to degree n when the θ_j are given arbitrarily. (auth)

5716 Remarks on the Variational Method for Scattering Problems. L. Hulthén and P. O. Olsson. Phys. Rev. 79, 532(1950) Aug. 1(Letter to the editor).

The authors show how principles covered in a former article (Hulthén, Arkiv Mat. Astron. Fysik 35A, No. 25(1948)) can be applied to those of Huang (Phys. Rev. 76, 1878(1949)) in the variational calculation of phase shifts. Better values are claimed, involving little extra work.

5717 Stochastic (Monte Carlo) Attenuation Analysis. Herman Kahn. Rand Corporation Report R-163, June 14, 1949. 20p.

Similar articles by the same author have appeared in Nucleonics 6, No. 5, 27(1950) May, Nucleonics 6, No. 6, 60 (1950) June, and Rand Corporation Report Rand-P-88. These have been abstracted and listed in Nuclear Science Abstracts as Abstracts 4-3795, 4-4051, and 3-990, respectively.

5718 Use of Sintered-glass Disk in the Preparation of Radioactive Precipitates. John J. Pinajian and John M. Cross. AECU-908, nd. 5p.

The authors have devised a convenient apparatus for collecting fairly large samples of radioactive precipitates in a reproducible manner. The precipitate is filtered, washed, dried, and subsequently counted on a modified sintered-glass filtering disc. 14 references.

5719 Victoreen Instruction Manual: Audeton, Model 376. Victoreen Instrument Company. AECU-912, nd. 58p.

The Pocket Audio Detector is a gamma-sensitive instrument consisting of a special subminiature Geiger tube, power unit, matching network, and miniature insert type earphone. Particular attention is called to the case construction, as considerable saving of size and weight were sacrificed in order to preserve the similarity between this instrument and its counterpart, the hearing aid, and at the same time

retain the features of reproducibility offered by the use of cast aluminum cases and fabricated construction. These are not, however, serious objections, only experimental necessities, which are readily overcome by the adoption of molded plastic parts in the production design. Inclusion of a voltage supply capable of accommodating a high voltage Geiger tube added further unnecessary bulk. With the advent of the type G-7 low voltage tube this reserve supply voltage had to be dissipated as wasted energy. Calculation of a condensed unit based upon these facts indicate a possible reduction of at least one-half in weight and one-third in size, with operating characteristics remaining unchanged. (auth)

5720 Ring Focusing in a Thin Lens Beta-Ray Spectrometer. W. W. Pratt, F. I. Boley, and R. T. Nichols. AECU-916, nd. 16p.

The existence of a ring-shaped constriction in the electron beam of a thin lens beta-ray spectrometer is demonstrated experimentally by a photographic film method. Making use of a photographic mapping of the beam, an annular baffle is designed. Optimum relations between annular width, solid angle and counter window diameter are investigated. A comparison of this type of baffle system with the original baffle system shows that at 2.5% resolution the spectrometer transmission may be increased by a factor of two by the use of an annular aperture in the region of beam constriction. (auth)

5721 Diamond Conduction Counters. Robert K. Willardson. AECU-917, nd. 7p.

Crystal conduction counters have the advantages of very fast resolving time, a pulse height which is proportional to the energy of the incident particle, and for γ rays, a high stopping power. The main disadvantage is the accumulation of a space charge field. This disadvantage can be overcome by irradiating a good counting diamond with red light while using it for counting, or by using the diamond in an activated counting condition. Some correlation between γ-counting properties, the 8 and 21 μ infrared absorption peaks and the photoconductivity of diamond is observed, but several conspicuous exceptions are noted. A tentative explanation of the activated counting condition involves an impurity or defect level about 3 ev below the conduction band. Activation of this impurity level is accomplished by γ counting with the diamond for many hours or irradiation of the γ-counting diamond with light of 3 to 4 ev of energy. (auth)

5722 Photoconductivity of Cadmium Sulfide. Dorris M. Ehret. ISC-52, May 4, 1950. 37p.

A low-frequency a-c amplification system was constructed and proved to give adequate response for detection of currents as low as 0.5 10^{-15} amp. A very pure cadmium sulfide crystal with gold electrodes about 0.11 cm apart and a sensitive area of about 0.075 cm^2 was irradiated with a monochromatic beam of light modulated at a frequency of 9.93 cycles/sec. The light source, monochromator, and mirror system were chosen and designed to provide a range of radiation from the near ultraviolet to about 3.5 μ in the near infrared. An electric field could be applied to the crystal. The measurements made determined that a maximum photocurrent in cadmium sulfide is produced by irradiating the crystal with energy of about 2.4 ev. Photoconductivity disappeared with energy slightly less than

this value, while a photocurrent, although of much lower magnitude than that of the peak, was produced by energies of higher values. The peak in photocurrent at 5100 A was steeper on the long-wavelength side than on the short-wavelength side. It was found that immediately after the electric field was removed from the crystal there was a sharp rise followed by a decrease in photocurrent. (auth)

5723 A Statistical Study of the Extent of Agreement between Pocket Meter and Film Meter Readings. W. F. Elkin. ORNL-514, June 30, 1949. 13p.

A statistical correlation was made on the readings of pocket and film meters of operations personnel over a six months period. Of 27 individuals, 25 had greater mean film readings than pocket meter readings. In general, agreement between the two types of meters was not good.

5724 A Portable Alpha Survey Meter. W. B. McDonald. ORNL-602 (Supplement) Aug. 15, 1950. 9p.

The use of a desiccant in the meter increases the service problem due to the fact that near microscopic sized particles find their way into the counting chamber thus producing a high background count. This supplement describes further development and redesign which eliminate the need for a desiccant.

5725 Distributed Coincidence Circuit. Clyde Wiegand. UCRL-776, June 28, 1950. 9p.

A coincidence circuit using the traveling wave principle as applied to distributed amplification is described. The resolving time is about 10^{-8} sec when the device is used in connection with scintillation detectors. (auth)

5726 A β-Spectrograph with High Dispersive Power. Joseph Lafoucrière. Compt. rend. 231, 137-9(1950) July 10 (in French).

A β-ray spectrograph which has a dispersive power $d\delta/dk = 2\pi(k^2-1)^{-3/2}$, where $k = rH/\rho H$, rH being a characteristic of the inhomogeneous field and ρ the radius of curvature of the β particle, combines the advantages of good focusing and good collection of particles.

5727 Cavity Ionization Chamber for Measurement of Absorbed X-radiation Energy. Theodore J. Wang. Nucleonics 7, No. 2, 55-71(1950) Aug.

The cavity ionization chamber has been widely used to circumvent the difficulties in determining dose in terms of the roentgen. It allows absolute measurement of energy absorbed locally from an x-ray beam. But many factors affect the accuracy of such measurements. These factors are considered in this article. The procedure followed here is: (1) An examination of the fundamental equation which relates the observed ionization to the energy absorbed. (2) A survey of the general conditions under which cavity ionization chambers are used. (3) Consideration of the accuracy to which evaluations can be made on the individual entities of the fundamental equation—these entities being relative specific local energy absorption, absorbed energy per ion pair, and ionization. (4) A brief review of comparative methods. 64 references. (auth)

5728 Clearing Up Nuclear Photographic Plates. C. Dilworth, G. Occhialini, and E. Samuel. Centre phys.

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nucleaire, univ. libre Bruxelles, No. 2, 1-2(1948) Aug. (in French).

A method for preventing plates from becoming opaque when developed is presented. The process includes immersion in an HCl solution with 1200 parts of water, rinsing, and then placing in a concentrated solution of hypo followed by a final rinse. This operation removes only very small particles which have been invisible under ordinary conditions of lighting and enlarging.

5729 The Control of a Wilson Cloud Chamber by Means of an Internal Counter. A. L. Hodson, A. Loria, and N. V. Ryder. Phil. Mag. 41, 826-37(1950) Aug.

A technique is described for controlling a Wilson cloud chamber by an internal counter whose cathode consists of a hexagonal array of rods and whose sensitive volume is not separated from the main cloud chamber volume by any wall and, in fact, forms part of the usable chamber volume. The counter has no stopping power beyond that of the gas unless the incident particle chances to hit one of the rods. Events in which heavily ionizing particles are produced in the cloud chamber, and events in which low energy particles traverse the chamber can thus be photographed. Discrimination between single fast particles or events of high ionization can be made at will. Altogether, 26 slow particles (excluding electrons) have been photographed, corresponding to a vertical intensity of 9.3×10^{-5} slow particles cm^{-2} min^{-1} $sterad^{-1}$ at sea level. Details of a proposed arrangement for photographing nuclear stars in the gas of the chamber are given. The technique is applicable to the study of the discharge phenomena of counters and some preliminary photographs of these phenomena are presented. The counter is quite stable and the technique of operation is not unduly difficult. (auth)

5730 Installation and Operating Instructions for Scaler Type AEP 908 and Auto-Control Unit Type AEP 116. W. D. Howell. Nat. Research Council Can. Report No. I.M-10, nd. 23p.

The Scaler Type AEP 908 is a comprehensive scaler system designed for standard rack or bench mounting. It consists of a base unit or chassis around which is built up, by employing plug-in units, scaler assemblies to meet particular requirements. The various assemblies are detailed. Provision is made for either manual or automatic operation (auth)

5731 Miniature I-F Amplifier; Model V; Terminal Report. Robert K-F. Scal. Nat. Bur. of Standards, May 1950. 46p. (AEC File No. NP-1662.)

A miniature high-gain, high-frequency, wide-band, intermediate-frequency amplifier is described. The plug-in type unit occupies about one-eighth the space and weighs about one-half as much as the unit it replaces, yet gives equivalent performance. The unit is manufacturable in quantity, and a brief description of efforts made toward this end is included. The circuitry is discussed, with emphasis on the use of subminiature tubes in low-noise input circuits. Heat-life tests are described which indicate that the amplifier can be operated in ambient temperatures as high as 100°C. (auth)

5732 Neutron Dose Determination by the Photographic Plate Method. E. W. Titterton and M. E. Hall. Brit. J. Radiology 23, 465-71(1950) Aug.

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The photographic plate technique, using boron- and lithium-loaded emulsions, has been applied to provide a slow neutron personnel monitoring service. The method is simple and economical in operation, and is sufficiently sensitive to reduce the necessary microscope work to insignificant proportions. Fast neutron personnel monitoring can be carried out quantitatively by employing the proton recoil tracks appearing in the same plates if the source is monochromatic in energy. Where fast neutrons of widely differing energies are present simultaneously it is usually a lengthy process to obtain an accurate dose determination. 14 references. (auth)

5733 A New Photographic Material—A High-Resolution Emulsion for Autoradiography. R. W. Berriman, R. H. Herz, and G. W. W. Stevens. Brit. J. Radiology 23, 472-7(1950) Aug.

The structure, properties, and manipulation of a new photographic material, designed for autoradiography to give the best possible resolution combined with reasonable sensitivity, is described. The new material consists of a glass support carrying a strippable 10-μ gelatin layer which carries on its upper surface a 4-μ thickness of fine grain "concentrated" emulsion (i.e., as used for nuclear track recording). For use, the composite gelatin emulsion layer is stripped off, floated onto the specimen whose autoradiograph is required, dried down, and exposed, processed, and examined with the emulsion in optical contact with the specimen. Estimates of the sensitivity of the emulsion are given in terms of the number of electrons incident per square centimeter to give a photographic density of 0.5 above fog and of the grain yield per incident electron, using P^{32} and I^{131} as radioactive sources. The resolving power was measured by making autoradiographs from radioactive test charts, and gave a value of at least 200 lines/mm. 10 references. (auth)

5734 Oxidation-Reduction Dyes as Radiation Indicators. Bernard E. Proctor and Samuel A. Goldblith. Nucleonics 7, No. 2, 83(1950) Aug.

The dye resazurin, when dissolved in agar, is converted by irradiation with cathode rays from blue to red to colorless. The amount of color change is proportional to the irradiation dosage, and the depth of this color change in agar is a function of the accelerating voltage of the electrons. This method of determining the extent of penetration of cathode rays in matter is accurate in the range of 300- to 3,000-kv electrons. This technique has also been successfully applied to measurement of field distribution of electrons.

5735 The Probability of Formation of Successive Disintegration Stars in Photographic Emulsions. R. Flament. Centre phys. nucleaire, univ. libre Bruxelles No. 3, 1-5(1948) Aug. (in French).

Consideration is given to successive disintegration stars produced by a radioactive series in equilibrium and in particular to the element actinium in such a series. It is reported that the probability of having a star due to the actinium in the natural isotopic mixture is always very slight. For an exposure time of more than 15 hr, it is a star of 5 branches caused by Rd Ac (Th^{227}) which shows the best chances for existence.

5736 A Radiation Meter for Disaster Use. C. C. Lauritsen and T. Lauritsen. Science 112, 137-40(1950) Aug. 4

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One form of radiation meter believed to be suitable in its major features for disaster use is illustrated. The instrument comprises essentially an electrostatic voltmeter of low capacity. It is mounted in a case that serves as an ionization chamber, and is provided with a friction charging device. The model illustrated is about the size of a cigarette package and would appear to be a practical choice for a pocket instrument. Another version is mentioned in the form of a pillbox 1.5 in. in diameter and 0.5 in. thick, conveniently carried on the wrist.

5737 Researches and Developments on the Spiral Orbit Spectrometer (I). Mitsuo Sakai. J. Phys. Soc. Japan 5, 178-84(1950) May-June.

The principle of the spiral orbit spectrometer is based on the consideration that when a charged particle starts radially from the central axis of a heterogeneous magnetic field of axial symmetry, which slowly decreases in the direction of increasing radius, it will describe a spiral orbit. If the proper relationship is fulfilled between the field strength and the momentum of the emitted particle, its orbit will converge to a definite circle at which is placed a Faraday cage. A description of the apparatus and the theory of operation are given. In addition, the theoretical conclusions are compared with experimental results.

5738 Researches and Developments on the Spiral Orbit Spectrometer (II). Mitsuo Sakai. J. Phys. Soc. Japan 5, 184-7(1950) May-June.

In the present paper the effect of intensity distribution of the magnetic field upon resolving power and solid angle is discussed. Analogous to the shimming of a cyclotron, an additional pole piece will increase the intensity without any degeneration of resolving power. Some experimental results on this subject are given here. (auth)

5739 Thermal Desensitizing of Nuclear Plates. M. Cosyns, C. Dilworth, and G. Occhialini. Centre phys. nucleaire, univ. libre Bruxelles, No. 6, 1-3 (1949) Jan. (in French).

It was considered desirable to find a method of desensitizing plates, until just before they were to be used, in a way that would not diminish their sensitivity during exposure. Following a series of tests the use of a mixture of dry ice and acetone is recommended for Ilford C_2 and Kodak NT2a. For more sensitive plates, at lower temperatures, liquid oxygen or liquid nitrogen is recommended.

5740 Interaction of 12- to 13-Mev Neutrons with Deuterons. G. L. Griffith, M. E. Remley, and P. G. Kruger. Phys. Rev. 79, 443-9(1950) Aug. 1.

By use of a CD_4-filled high pressure cloud chamber, the angular distribution of recoils from 12- to 13-Mev neutrons has been studied. The angular range 0 to 140 deg in the center-of-mass system was covered by these measurements. The distribution indicates a rather large asymmetry in the forward and backward directions with a minimum at about 60 deg in the center-of-mass system. The existence of a D(n,2n)p reaction was evident by the presence of tracks between 60 and 90 deg in the laboratory system which were too long to be accounted for by either deuteron or proton elastic recoils. (auth)

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5741 Nuclear Shielding Studies. I. The Slowing Down and Diffusion of Neutrons in Hydrogenous Media (Technical Report No. 21). C. W. Tittle. Massachusetts Institute of Technology, Aug. 31, 1949. 73p. (AEC File No. NP-1318.)

Knowledge of the spatial distribution of neutrons in hydrogenous media is important in the design of radiation shields. Heterogeneous mixtures of Bi + H_2O, Pb + H_2O and Fe + H_2O have been studied by Munn and Pontecorvo (Can. J. Research 25A, 157-67(1947)). Before extending this work, a comparison has been made between homogeneous and heterogeneous mixtures of carbon, hydrogen, and oxygen having the same C:H:O ratios per unit volume. Source, 150 mg Ra-α-Be; homogeneous mixture, furfural $C_5H_4O_2$; heterogeneous mixture, Acheson graphite and water. Intensities of thermal and indium resonance neutrons were measured to distances of 54 and 30 cm, respectively, from the source using In and Cd-In-Cd foils. A checkerboard lattice consisting of rods of graphite (1.92 cm × 1.92 cm) spaced 0.77 cm apart in water, when corrected for minor differences in atomic concentrations, gave distributions equivalent to the homogeneous mixture beyond 12 to 20 cm (12, indium resonance; 20, thermal). Slabs of graphite 1.92 cm thick spaced 1.83 cm under equivalent conditions gave the same distributions beyond 14 to 24 cm. At 4 cm the intensity ratios for thermal neutrons were 1.00:0.91:0.81::furfural:checkerboard:slab. Several investigators have considered approximate means of improving upon age theory for hydrogenous materials. Of these, Flugge was the first to carry out the numerical integration. (Physik. Z. 44, 445-55(1943)). With the aid of these computations, it is possible to apply the theory to any hydrogenous mixture with very little additional work. The Flugge theory is reviewed and a method is developed for evaluating one of the dimensional constants. (auth)

5742 Variational Principles for Scattering Processes. I. B. A. Lippmann and Julian Schwinger. Phys. Rev. 79, 469-80(1950) Aug. 1.

A systematic treatment is presented of the application of variational principles to the quantum theory of scattering. Starting from the time-dependent theory, a pair of variational principles is provided for the approximate calculation of the unitary (collision) operator that describes the connection between the initial and final states of the system. An equivalent formulation of the theory is obtained by expressing the collision operator in terms of an Hermitian (reaction) operator; variational principles for the reaction operator follow. The time-independent theory, including variational principles for the operators now used to describe transitions, emerges from the time-dependent theory by restricting the discussion to stationary states. Specialization to the case of scattering by a central force field establishes the connection with the conventional phase shift analysis and results in a variational principle for the phase shift. As an illustration, the results of Fermi and Breit on the scattering of slow neutrons by bound protons are deduced by variational methods. (auth)

5743 Variational Principles for Scattering Processes. II. Scattering of Slow Neutrons by Para-Hydrogen. B. A. Lippmann. Phys. Rev. 79, 481-6(1950) Aug. 1.

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Continuing the illustrative example of the preceding paper (NSA 4-5742), the scattering of slow neutrons by two protons bound to a molecule is treated by variational methods. A numerical evaluation indicates that the Fermi approximation to the para-hydrogen cross section is reliable to about 0.3%.

5744 Nuclear Magnetic Resonance of Sb^{121} and Sb^{123}. V. W. Cohen, W. D. Knight, T. Wentink, Jr., and W. S. Koski. AECU-902, May 8, 1950. 2p.

Using a r-f magnetic spectrometer, magnetic resonances of 9800 and 5300 kc were observed in $HSbCl_6$ in HCl which could be associated with Sb^{121} and Sb^{123}, respectively. Taking the spin of Sb^{121} and Sb^{123} as 5/2 and 7/2, respectively, and determining their gyromagnetic ratio from the magnetic resonance frequencies, their magnetic moments are calculated as 3.3595 ± .0004 and 2.5470 ± .0003 nuclear magnetons.

5745 Nuclear Energy Levels in Lead Isotopes. R. E. Peterson, R. K. Adair, and H. H. Barschall. AECU-920, nd. 9p.

The total neutron cross section of radio-lead was studied as a function of neutron energy in the range from 15 to 750 kev, using energy resolutions of 3 to 10 kev. Several resonances were observed; these were interpreted as caused by energy levels in the compound nucleus Pb^{207}. The level spacing found in Pb^{207} was of the order of 50 kev. Maxima previously found in the cross section of ordinary lead and attributed to resonance interactions of neutrons with Pb^{208} were more sharply defined, using better energy resolution. No resonances were observed when earlier measurements of the cross section of Bi were extended to higher energies. (auth)

5746 An Estimate for the Position of the Lowest Dipole-level of a Nucleus. B. F. Touschek. Phil. Mag. 41, 849-51 (1950) Aug.

The completeness property of the set of nuclear eigenfunctions can be used to obtain an inequality for the position of the lowest dipole level of a nucleus. The method used by Feenberg (Phys. Rev. 49, 328 (1935)) to obtain a lower limit for the energy of a hypothetical excited state of He^4 is adapted to any nuclear system, although the actual evaluation of the limiting value for the excitation energy can only be carried out on the basis of a strongly simplified nuclear model. By considering two extreme cases it is shown that the limiting value of the excitation energy does not depend critically on the model used for its derivation. The methods outlined for dipole transitions can be used for higher multipole transitions. The author concludes that all nuclei with A > 70 should have at least one quadrupole level in the discrete spectrum and the corresponding value for at least one dipole level is A > 8.

5747 Gamma-Gamma-Correlation Experiments. J. R. Beyster and M. L. Wiedenbeck. Phys. Rev. 79, 411(1950) July 15 (Letter to the editor). (See also NSA 4-5528.)

Gamma-gamma angular correlation curves are shown for Co^{60}, Cs^{134}, Ag^{110}, and Rh^{106}. A possible explanation of the Cs^{134} distribution rests on the assumption that, of its three γ transitions, the lower two are between states with J = 4, 2, and 0 and that the upper one is quadrupole with J = 4, 5, or 6 for the uppermost state.

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5748 Nuclear Energy Level Argument for a Spheroidal Nuclear Model. James Rainwater. Phys. Rev. 79, 432-4(1950) Aug. 1.

In this paper it is shown that an extension of the logic of the spherical nuclear model leads to the prediction that greater stability is obtained for a spheroidal than for a spherical nucleus of the same volume, when reasonable assumptions are made concerning the variation of the energy terms on distortion. The predicted quadrupole moment variation with odd A is in general agreement with the experimental values as concerns variation with A, but is even larger than the experimental values. Since the true situation probably involves considerable "dilution" of the extreme single particle model, it is encouraging that the present predictions are larger rather than smaller than the experimental results. A solution is given for the energy levels of a particle in a spheriodal box. (auth)

5749 The Nuclear Quadrupole Moment of N^{14} and the Structure of Nitrogen Trifluoride from Microwave Spectra. John Sheridan and Walter Gordy. Phys. Rev. 79, 513-15(1950) Aug. 1.

Measurements of the J = 1 → 2 rotational transitions of $N^{14}F_3$ and $N^{15}F_3$ yield the following molecular and nuclear properties. For $N^{14}F_3$, B_0 = 10,680.96 Mc/sec, I_B = 78.5475 × 10^{-40} g cm²; for $N^{15}F_3$, B_0 = 10,629.35 Mc/sec, I_B = 78.9291 × 10^{-40} g cm². The molecular dimensions are: d_{NF} = 1.371A and the angle FNF = 102 deg and 9 min. The nuclear quadrupole coupling of N^{14} is −7.07 Mc/sec. This yields +0.01 × 10^{-24} cm² as the most probable value of the nuclear quadrupole moment of N^{14}.

5750 Proton-Neutron Reactions and Thresholds. H. T. Richards, R. V. Smith, and C. P. Browne. AECU-918, nd. 14p.

Threshold proton energies for neutron emission have been carefully determined for Be^9, B^{11}, C^{13}, O^{18}, Cl^{37}, K^{41}, V^{51}, Mn^{55}. Thin-target yield data up to about 4-Mev proton energy is reported for Be^9, B^{11}, O^{18}, and K^{41}. A summary of all reported p-n thresholds for Z ≤ 25 is included. Isobaric mass differences from p-n measurements and from beta-ray end points are compared. Data concerning the suitability of various p-n reactions as controlled-energy neutron sources are included. 12 references. (auth)

5751 Excitation Functions for Spallation Reactions on Cu. F. O. Bartell, A. C. Helmholz, S. D. Softky, and D. B. Stewart. UCRL-757, June 20, 1950. 24p.

Excitation functions have been measured for 190-Mev deuterons from the 184-in. Berkeley cyclotron on the natural isotopic mixture of Cu^{63} and Cu^{65}. Chemical separation of Zn, Cu, Ni, Co, Fe, and Mn has been performed and the yields of several of the radioactive isotopes of these elements have been measured as a function of deuteron energy. Results are discussed which seem in accord with Serber's theory of high-energy processes and with other information on the yields of nuclear reactions at these energies. 14 references. (auth)

5752 Angular Correlation between α-Particles and γ-Rays in the Reaction $F^{19}(p, \alpha\gamma)C^{16}$. C. A. Barnes and A. P. French. Nature 166, 145(1950) July 22 (Letter to the editor).

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The correlation between the directions of emission of alpha particles and gamma rays at the 340-kev resonance in the following reaction: $F^{19} + p \rightarrow Ne^{20*} \rightarrow O^{16} + \alpha \rightarrow O^{16} + \gamma + \alpha$ is reported. From a plot of the number of coincidences as function of the angle θ between the α-particle counter and the γ-ray counter various conclusions are reached.

5753 Experimental Studies of High-energy Nuclear Reactions. Technical Report No. 4. Bernard L. Cohen. Carnegie Institute of Technology. May 20, 1950. 128p. (AEC File No. NP-1621.)

Calculations are made of neutron energy spectra to be expected from compound nucleus decay using Weisskopf's exact formula and considering "2n" reactions, target thickness, and center of mass motion. A new and very rapid method of measuring neutron spectra is suggested and justified and several measured spectra are presented. Temperatures are calculated from these, and from data on (α,p) and (d,p) reactions appearing in the literature, giving values about 20% higher than Weisskopf's theoretical values, and very much larger than Gugelot's (Phys. Rev. 76, 463(1949)) measured values from (p,n) reactions. The situation is discussed and further experiments are suggested. Experimental observables are derived from Wolfenstein's theory of angular distributions. Methods of measuring angular distributions are analyzed and it is concluded that using silver detectors outside the cyclotron vacuum chamber is very adequate. Existing data on angular distributions of neutrons from (α,n) reactions is corrected and analyzed, and shown to verify the theory. Assuming the theory, a very simple and rapid method of measuring neutron temperatures is proposed and tested. The ratio of intensities at 0 and 90° is shown to be remarkably constant for all elements, suggesting that a calculation of this value might be interesting. The Weisskopf theory of nuclear reactions is sketched and existing experiments are analyzed to prove that in alpha-particle capture, $r_0 = 1.5 \times 10^{-13}$ cm, with 2.0×10^{-13} cm being entirely out of question. Measurements of (n,2n) and (n,p) cross sections are presented, including an elaborate method of correcting for self-absorption of beta rays. Observed (n,p) cross sections are compared with the predictions of statistical theories, and conclusions are drawn about the degree of validity of the latter and about the interpretation of some of their fine points. Observed (n,2n) cross sections are compared with the statistical theory prediction and shown to be too small. Weisskopf's theory for explaining this is shown not to improve the agreement, and an alternative modification of the standard theory is proposed and justified, and shown to agree with the experimental results. The situation is discussed and further experiments are proposed. For deuteron-induced reactions, existing data on angular distributions is corrected and analyzed to show that some process other than a compound nucleus interaction is important for producing neutrons in the forward direction in (d,n) reactions. Neutron energy spectra that would be expected from a stripping process and a compound nucleus process in the forward direction are calculated, and measured spectra are presented. It is shown that these are in bad disagreement with the predictions of a compound nucleus interaction, and in fair agreement with the predictions of a stripping interaction which occurs after the deuteron has surmounted most of the Coulomb barrier at the expense of its forward momentum. Measured spectra are presented which show that in producing neutrons at large angles, a compound nucleus interaction is predominant. Calculations on existing data on (d,n) cross sections are presented as strong evidence that the interaction at all angles is one in which a charged particle (either a deuteron or a proton) is captured. 61 references. (auth)

5754 (n,2n) and (n,p) Cross Sections. B. Cohen. Carnegie Institute of Technology. Technical Report No. 3, Nov. 15, 1949. 24p. (AEC File No. NP-1254.)

Relative cross sections of several (n,2n) and (n,p) reactions were obtained by bombarding samples with neutrons and measuring the induced beta activity. The neutrons were obtained by bombarding an internal thick beryllium target with 14-Mev deuterons from the University of Pittsburgh cyclotron. The low-energy portion of the neutron energy spectrum was determined by measuring tracks of recoil protons in 200-μ NTB photographic emulsions. Results are discussed in light of Weisskopf's nuclear cross section formulas based on nuclear temperatures. 16 references.

5755 A 1.0-Mev Energy Level in C^{13}. Isadore B. Berlman. Phys. Rev. 79, 411(1950) July 15 (Letter to the editor).

The protons from the reaction $C^{12}(d,p)C^{13}$, between 10-Mev deuterons and a C target, were recorded in emulsion. At 90 deg to the cyclotron beam there was a homogeneous group of particles which was attributed to this reaction. There were no recoil particles from cases in which C^{13} was left in the 1.0-Mev excited state. However, at 115 and 155 deg there were two prominent groups of proton tracks, the first of which was analyzed as being due to the above reaction where C^{13} was left in the ground state, and the second as being due to the reaction where C^{13} was left in the 1.0-Mev excited state. These results indicate that there is an angular dependence for the second group of tracks.

5756 Photo-Fission of Bismuth. Nathan Sugarman. Phys. Rev. 79, 532-3(1950) Aug. 1 (Letter to the editor).

Bismuth was irradiated with photons from a betatron operating at 85 Mev. Analyses were made for various elements regarded as probable fission products. The relative yields of 14 nuclides are tabulated and compared with predicted values and with deuteron-fission values. It remains to be established definitely that the fission process is not the result of secondary fast particles in the bismuth.

5757 Production of Beryllium-7 by Proton Bombardment of Carbon. J. M. Dickson and T. C. Randle. Nature 166, 235(1950) Aug. 5 (Letter to the editor).

Graphite disks of high purity were irradiated for about 1 min with 160-Mev protons from the 110-in. Harwell cyclotron, and were found to emit γ rays with a half-life of about 50 days and energy about 0.5 Mev (measured by absorption in lead), in addition to the 20-min positron activity from the well known reaction $C^{12}(p,pn)C^{11}$. Radiochemical analysis showed that an isotope of beryllium was responsible for the long-period activity. The half-life and γ-ray energy agree with the known values for Be^7. In preliminary measurements the cross section for production of Be^7 from C^{12} by 160-Mev protons was found to be 11 millibarns ±20%. It is

assumed that the reaction $C^{12}(p,3p3n)Be^{7}$ has occurred, with a possibility that the protons and neutrons may be ejected in various combinations involving deuterons, tritons, and α particles.

5758 Pressure Gradient in a Synchrotron Vacuum Tube. William Liben. AECU-894, nd. 2p.

The pressure gradient resulting from surface gassing and leakage in the accelerating chamber of the Brookhaven Synchrotron is calculated by solving the gas-diffusion equation.

5759 Design of a Wide-Band Radio-Frequency Power Amplifier for a 2.5-Bev Proton Accelerator. Luke C. L. Yuan. AECU-896, nd. 9p.

The operating characteristics have been determined for a class B push-pull circuit using a pair of ML-354 power tubes to drive a one- or two-turn coil, wound on a ferrite core. This arrangement provides the accelerating voltage for a 2.5-Bev proton-synchrotron. It was found that the one-turn is preferable to the two-turn coil.

5760 Extraction of the Electron Beam from a 30-Mev Synchrotron. J. D. Lawson, H. E. Walford, and J. H. Aram. Nature 166, 234-5(1950) Aug. 5 (Letter to the editor).

Electrons of energy up to 20 Mev have been extracted from the 30-Mev synchrotron at the Harwell Atomic Energy Research Establishment with the aid of a small shunt coil carrying a pulse of current. The electrons are injected into the synchrotron from inside the equilibrium orbit, and are extracted when the magnetic field has reached its maximum value. The extraction occurs in two stages: the orbit is first expanded by means of pulsed coils above and below the donut; this causes the electrons to spiral outward until they reach the extractor shunt; the shunt then deflects them tangentially out of the machine. No measurement of the extraction efficiency has yet been made, though very rough estimates indicate that the figure probably lies between 15% and 50%.

5761 Principle of an Ion Source for Intense Beams. Ch. Cassignol. Nature 166, 233-4(1950) Aug. 5 (Letter to the editor).

Space charge in the vicinity of the extraction aperture of an ion source has been reduced by a modification of the configuration of the extraction field. The extracting electrode is a short cylinder coaxial with the accelerating tube, and the ions pass through a circular slit, machined in this cylinder. The trajectories are parabolas, all of which cross the axis of the tube at the same point if the beam is homogeneous in energy. For a suitable ratio of the extracting to the total accelerating voltage, this point coincides with the target at the lower end of the tube. An electric field for focusing the positive ions onto the extracting slit is used.

5762 Distributed Beta Sources in Uniformly Absorbing Media. II. Harald H. Rossi and R. Hobart Ellis, Jr. Nucleonics 7, No. 2, 19-23(1950) Aug. (See also NSA 4-5103.)

As a follow-up to the theoretical considerations published in Part I of this article, (Nucleonics 7, No. 1, 18(1950)), practical examples are given here in which the relations found for simple shapes of uniformly distributed beta sources

are applied to cases involving more complicated geometries. These results may be useful, also, where nonuniform distribution exists in biological systems. (auth)

5763 The Effect of Nuclear Structure on the Elastic Scattering of Fast Electrons. L. R. B. Elton. Phys. Rev. 79, 412-13(1950) July 15 (Letter to the editor).

The cross section for the scattering of electrons by atomic nuclei has been investigated at energies for which the nuclei can no longer be treated as point charges. Three nuclear models were used: (a) point charge, (b) uniform spherical charge distribution of radius R, (c) uniform spherical shell charge distribution of radius R. Because of the electrostatic repulsion of the charges inside the nucleus, the charge density is likely to increase with the radius, so the true distribution is likely to be somewhere between models (b) and (c). The ratio of the differential cross section for an extended nucleus, (b) and (c), to that of a point nucleus, (a), is given for the cases of Al and Au at various angles and compared with preliminary experimental results.

5764 An Experimental Study of the Diffusion of β Rays in Metallic Foils. Julien Verhaeghe and Joseph Allewaert. Compt. rend. 231, 135-7(1950) July 10 (in French).

β rays were diffused through sheets of copper, carbon, and gold and the angular deviation, α, caused by small partial deviations repeated a large number of times, was measured by a cloud chamber in a magnetic field. The total number of deviations plotted against the average of $\alpha H\rho$, where H is the magnetic field and ρ the radius of the electron in the cloud chamber, gave a Gaussian distribution, in agreement with the calculations of E. J. Williams (Proc. Roy. Soc. 169A, 531(1938); Phys. Rev. 58, 292(1940)).

5765 Ratio of Cross Sections for Electron Capture and Electron Loss by Proton Beams in Metals. Theodore Hall. Phys. Rev. 79, 504-12(1950) Aug. 1.

Measurements have been made of the ratio of the charged to the neutral component (protons to hydrogen atoms) in hydrogen ion beams of energies between 20 and 400 kv, passing through the metallic media beryllium, aluminum, silver, and gold. The data show that this ratio is the same, within the accuracy of the experiment, for the three lighter elements, but is slightly less in gold above 100 kv. The curves depicting this ratio as a function of ion speed cannot be fitted by a power law over the entire energy range, but the high energy end of the data can be fitted fairly well in this way. At 350 kv, the slopes correspond to a dependence on ion speed v of the form v^{8} in the case of the lighter elements, and v^{7} in the case of gold. The cross sections for electron capture and electron loss are found to be equal at an ion energy of 26 kv. The ion then has a speed 0.95 times that of the hydrogen orbital electron ($e^2/\hbar$).

5766 Scattering of 3.27-Mev Neutrons by Deuterons in the Wilson Chamber. I. Hamouda, J. Halter, and P. Scherrer. Phys. Rev. 79, 539(1950) Aug. 1 (Letter to the editor).

A study was made of the angular distribution of neutrons scattered by deuterons in a cloud chamber, 3.27 Mev D-D neutrons being used. Comparison of the distribution with the "ordinary force" and "exchange force" curves of Mas-

sey and Buckingham (Phys. Rev. 71, 558(1947)) shows better agreement with the latter curve. Details will be published in Helv. Phys. Acta.

5767 The Disintegration of Praseodymium 142. Erling N. Jensen, L. Jackson Laslett, and D. J. Zaffarano. AECU-877, nd. 18p.

The radiations from Pr^{142} have been examined with a thin-lens spectrometer. One γ ray was found having an energy of 1.57_6 Mev. The β spectrum is complex, the two groups observed having maximum kinetic energies of 2.15_4 Mev and 0.63_6 Mev. It is suggested that the high-energy β group gives a transition to the ground state of Nd^{142} and that the γ ray follows the low-energy β transition. The half-life was found to be 19.1 hr. The electron distribution produced by bremsstrahlung, due to the absorption of the β rays, was observed. 23 references. (auth)

5768 First-Forbidden Beta-Spectra and the Beta-Spectrum of Sr^{90}-Y^{90}. L. Jackson Laslett, E. N. Jensen, and A. Paskin. AECU-882, nd. 5p.

The usual correction factor $(W_0 - W)^2 + (W^2 - 1)$ for first-forbidden β spectra is modified to $(w_0 - w)^2 + \Lambda(w^2 - 1)$, Λ having a dependence on the electron momentum and differing appreciably from unity for large Z. The slight improvement in the modified Kurie plots for Sr^{90} and Y^{90} is discussed.

5769 The Genetic Relationship in Ag^{110}. John Miskel. AECU-890, nd. 4p.

That the 270-day activity in Ag^{110} is that of a level isomeric with the 24-sec ground state was confirmed by repeated separations of the shorter-lived activity from the longer. The sample was prepared as an ether solution of silver tetraphenylporphin and a potential difference of 600 volts was applied to Cu electrodes at 3 mm spacing. Both electrodes then displayed the short-lived activity. Partial separation was obtained on a Cu electrode with no applied potential but none was obtained on an uncharged Pt electrode.

5770 Measurement of Absolute Electron Capture Rates; Application to the Decay of Ni^{57}. G. Friedlander, M. L. Perlman, D. Alburger, and A. W. Sunyar. AECU-893, nd. 17p.

Observation of radiations from 36-hr Ni^{57} with a proportional counter and pulse height analyzer shows that cobalt x-rays are emitted. Decay is divided equally between K capture and emission of 845-kev positrons. The positron spectrum has the allowed shape. Coincidence measurements involving the comparison of Ni^{57} and Na^{22} give the result that both K capture and positron emission in Ni^{57} are followed by emission of a 1.9-Mev γ quantum. In the K branch there are some 120-kev γ rays and possibly others of energy less than 0.5 Mev in cascade with the hard γ's.

5771 Isomerism in Pb^{204} and "Memory" in Angular Correlation. A. W. Sunyar, D. Alburger, G. Friedlander, M. Goldhaber, and G. Scharff-Goldhaber. AECU-906, May 1, 1950. 5p.

The only even-even nucleus for which a fairly long-lived metastable state is known is Pb^{204}. Here a life time of 65 to 68 min has been reported for an isomeric transition with an

energy of about 1 Mev. From γ-ray coincidence studies it was found that the isomeric transition takes place in two steps. To obtain the exact energies of the transitions, the internal-conversion electrons of Pb^{204m} were studied in a lens spectrometer. The K and L lines of γ rays of 374-kev and 905-kev energy were observed. No further electron lines were found in the region from 70 kev to 1.7 Mev. Delayed coincidences between the conversion electrons were found with Geiger counters, and between the γ rays with scintillation counters as detectors. The half-life of the second step is 3×10^{-7} sec. Absorption measurements showed that the 905-kev transition precedes the 374-kev transition. The combination of half-lives, energies, K/L ratios, and conversion coefficients is best compatible with the interpretation that the 68-min transition is of multipole order 6 and the 3×10^{-7}-sec transition is of multipole order 3, although multipole orders lower by one unit cannot be excluded in either transition. A decay scheme and some possible spin and parity assignments are also shown. Because of the high spin changes involved, the angular correlation between the two γ rays would not be expected to show spherical symmetry, except if "memory" of spin orientation were not retained for a measurable time by the 3×10^{-7}-sec state. In order to decide this question the angular correlation between the 905-kev and the 374-kev γ rays was measured with a 5×10^{-7}-sec delay and a resolving time of 2×10^{-7} sec. Tl-activated NaI scintillation counters were used as detectors. The ratio of coincidences at 180 deg to those at 90 deg was found to be 1.22 ± 0.05. Thus is definitely established the existence of "memory" of spin orientation for a time at least as long as 5×10^{-7} seconds. (auth)

5772 Alpha Radioactivity and the Stability of Heavy Nuclei. I. Perlman. Nucleonics 7, No. 2, 3-18, 25(1950) Aug.

The author presents a brief account of the theory of α decay and its relation to nuclear theory and nuclear stability. He then describes some of the experimental techniques of α-particle counting and of analyzing α energies in a mixture of emitters. An explanation is given of the energy surface in the heavy element region and the method of predicting α-particle energies as in berkelium and californium. Finally, he gives an account of nuclear models on the basis of α-particle decay. 18 references.

5773 The Beta-Spectra of Zn^{62} and Cu^{62}. Raymond W. Hayward. Phys. Rev. 79, 541-2(1950) Aug. 1 (Letter to the editor).

Zn^{62} was found to decay about 10% of the time by positron emission (0.66 ± 0.01 Mev upper limit) and the rest of the time by K-capture, with a half-life of 9.33 hr. A γ ray of 41.8 ± 0.2 kev was assigned to the daughter Cu^{62}, the positron emission of the latter having an upper limit of 2.92 ± 0.02 Mev.

5774 The Beta-Spectrum of Sn^{125}. Raymond W. Hayward. Phys. Rev. 79, 409(1950) July 15 (Letter to the editor).

A Fermi plot of the β spectrum of Sn^{125}, exhibiting the characteristic nonlinearity associated with the type of forbidden spectrum in which a spin change of 2 units and a parity change occur in the transition, was modified by divid-

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ing the ordinates by $(p^2 + q^2)^{1/2}$. Here p and q are the momenta of the electron and neutrino, respectively. The resulting linear plot showed an end point energy of 2.37 ± 0.02 Mev.

5775 Decay of Au^{199}. R. D. Hill. Phys. Rev. 79, 413-14 (1950) July 15 (Letter to the editor).

The radiations from a Au^{199} source separated from Pt^{199} have been studied and the electron conversion spectrum is given. Gamma rays of 50 ± 1, 158.5 ± 0.3, and 208.5 ± 0.3 kev were indicated and the multipole orders of the various transitions are speculated upon. A slow neutron-capture cross section of 1.6×10^4 barns is deduced for Au^{199}.

5776 Decay Constants of K^{40}. G. A. Sawyer and M. L. Wiedenbeck. Phys. Rev. 79, 490-4(1950) Aug. 1.

New measurements have been made of the decay constants of K^{40} for β-ray emission and for electron capture, and a decay scheme is proposed on the basis of these measurements and the previous data. Special counters adapted to the measurement of low levels of activity were developed for making the measurements. The results obtained were 28.3 ± 1.0 β rays per gram of K per second and 13.5 ± 4.0 electron captures per 100 β rays, corresponding to a total half-life of $12.7 \pm 0.5 \times 10^9$ yr, with 88% of the decays by β-ray emission and 12% by electron capture. A previous measurement of the γ-ray intensity in K^{40}, by the present authors, gave 3.6 ± 0.3 γ rays per gram of K per second, or about 12.7 γ rays per 100 β rays. Since the numbers of γ rays and of electron captures in the decay of K^{40} are essentially the same, and since previous measurements indicate that the γ energy is greater than the β energy, it is proposed that the γ ray be associated with the electron-capture decay, a γ ray following each electron capture. (auth)

5777 The Disintegration of Ruthenium 103 and Palladium 103. J. Y. Mei, C. M. Huddleston, and Allan C. G. Mitchell. Phys. Rev. 79, 429-32(1950) Aug. 1.

The β- and γ-ray spectra of Ru^{103} (43 days), Pd^{103} (17 days), and Rh^{103m} (56 min) have been investigated in a magnetic lens spectrograph. Ru^{103} disintegrates with the emission of two β-ray groups of end point energies 0.684 Mev (6%) and 0.204 Mev (94%) together with a γ ray of 0.494 Mev and an internally converted γ ray of 40.4 kev energy. Pd^{103} disintegrates by orbital electron capture. The spectrum consists of an electron line at 36.9 kev, shown to be due to L electrons from a highly converted γ ray of 40.4 kev energy, together with Auger electrons. The spectrum of the metastable Rh^{103m}, whose half-life has been determined as 56 min, consists of an L conversion line for a γ ray of 40.4 kev, with some indication of the presence of the K-line. Ru^{97} (2.8 days) was also measured and found to emit a γ ray of 0.217 Mev.

5778 A 5.7×10^{-9}-Sec Isomeric State in $_{77}Ir^{191}$. F. K. McGowan. Phys. Rev. 79, 404-5(1950) July 15 (Letter to the editor).

Delayed coincidence measurements of the activity in Os^{191} revealed a 5.7×10^{-9}-sec electron activity following the 32-hr β decay of the osmium. The energy of the electrons was found to be 52 kev, indicating L-shell conversion in the decay of a 65 ± 5 kev isomeric state of Ir^{191}.

5779 Freeze Radon to Prepare Alpha-Ray Source. Nucleonics 7, No. 2, 83-4(1950) Aug.

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A method for preparing a homogeneous constant source of alpha rays which will be free from emanation has been patented by Marietta Blau and Boris Pregel. It is claimed that no radioactive material is destroyed in the process of preparing the Ra D-Ra E-polonium source. A strong radium solution, such as $RaBr_2$ or $RaCl_2$ in water, is heated in an oven to promote the formation of radon gas. After passing through purifying apparatus, the radon is collected in a freezing chamber containing a very fine metallic or plastic powder. The chamber and powder are maintained at a low temperature by immersion in liquid air, and the radon is therefore deposited in solidified form in the powder. The solidifying of the radon makes it possible to obtain concentrations far higher than would result from its use in the gaseous state. The frozen emanation and powder is disconnected from the supply and allowed to stand for about three days. The radon decays in this time to radium D. With a half-life of 22 years, RaD is the mother substance of RaE, which disintegrates to polonium. The equilibrium products of the source are not high-energy gamma emitters, and the source is, for all practical purposes, free of emanation. The powder can be pressed or rolled onto a metal backing or may be used in any other way desired. Since the polonium is in equilibrium with the RaD, the source will have a long life.

5780 The Isotopes of Americium. K. Street, Jr., A. Ghiorso, and G. T. Seaborg. Phys. Rev. 79, 530-1 (1950) Aug. 1 (Letter to the editor).

Bombardment of Pu^{239} with 50-Mev deuterons results in the production of a new americium activity of ~1.2 hr half-life in addition to the previously reported 12- and 50-hr activities. Differential counting with beryllium and lead absorbers indicates that the decay is accompanied by the emission of conversion electrons and x-rays. This activity is probably that of an orbital-electron-capturing isotope and is best assigned to Am^{238}.

The 12-hr orbital-electron-capturing Am^{239} has been previously reported to decay by α-particle emission to the extent of ~0.1%. A re-determination of the α-branching ratio yielded the better value ~0.01%. The energy of the α particle has been determined by means of a multichannel pulse analyzer to be 5.77 ± 0.05 Mev.

The assignment of the 50-hr electron-capturing americium activity to Am^{240} has been confirmed. No α particles associated with this activity have been observed. This is consistent with its assignment to Am^{240} since the systematics of α radioactivity predict for this odd-odd nucleus a partial half-life for α of some 10^3 yr.

The production of Am^{241} in milligram amounts by the neutron irradiation of plutonium makes it possible to study the higher-mass isotopes of americium produced by (n,γ) reactions. The new half-life for Am^{241} is 475 yr.

Am^{242} is assigned a 0.575 ± 0.010-Mev β activity of ~100 yr and an α activity of ~10^4 yr. Am^{242m} (16 hr) is assigned a 0.630 ± 0.005-Mev β activity.

Am^{243} is produced by two successive neutron captures in Am^{241}, the successive cross sections being roughly $10^{-23}cm^2$ and $4 \times 10^{-21}cm^2$ but subject to large errors. Am^{243} emits α particles of 5.21 ± 0.03 Mev with a half life of ~10^4 yr. A lower limit of 10^9 yr is deduced for possible β^- emission not observed.

Irradiation of Am^{243} with thermal neutrons produced a new americium activity of ~25-min half life at a yield correspond-

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ing to a cross section of roughly $\frac{1}{2} \times 10^{-22}$ cm^2. This activity is probably caused by the β-emitting isotope Am^{244}, formed by an (n,γ) reaction.

5781 On the Decay of Xe^{133m}. Ingmar Bergström and Sigvard Thulin. Phys. Rev. 79, 538-9(1950) Aug. 1 (Letter to the editor).

Beta-spectrometer measurements of Xe^{133}, produced in uranium fission, showed an upper limit of 345 kev for the β spectrum. Conversion electrons indicated γ rays of 81 and 232 kev. The 81-kev γ is assigned to an isomeric transition in Cs^{133} and the 232 kev γ to one in Xe^{133}. In the proposed decay scheme the β decay is from metastable Xe^{133m} to metastable Cs^{133m}. Spins and parities are discussed, the failure to observe a β decay of the Xe^{133} ground state being found consistent with the improbability of the transition.

5782 On the Isomerism of Kr^{85}. Ingmar Bergström and Sigvard Thulin. Phys. Rev. 79, 537(1950) Aug. 1 (Letter to the editor).

Beta-spectrometer measurements of Kr^{85} gave a β-energy maximum at 817 kev and conversion-electron energies corresponding to γ rays of 149 and 300 kev. A proposed decay scheme illustrates the 300-kev transition as being from the 4.4-hr isomeric level to the ground state in Kr^{85}, and the β decay as being to a 149-kev level in Rb^{85}. Spins and parities are discussed, and it is concluded that the ground state of Kr^{85} has spin $\frac{1}{2}$ or $\frac{9}{2}$.

5783 The Sn^{117} Isomeric Activity. Raymond W. Hayward. Phys. Rev. 79, 542(1950) Aug. 1 (Letter to the editor).

From measurement of conversion electrons, the energy of the 14-day isomeric transition in Sn^{117} is deduced to be 0.157 ± 0.002 Mev. A mixture of 2^5-pole electric and 2^4-pole magnetic radiation is postulated to account for the K/L conversion ratio of 2.2.

5784 Spectrometer and Coincidence Studies on Np^{238}. M. S. Freedman, A. H. Jaffey, and F. Wagner, Jr. Phys. Rev. 79, 410-11(1950) July 15 (Letter to the editor).

Np^{238} was found to decay to Pu^{238} by emission of 0.258 and 1.272 Mev β rays. The energies of five γ rays were also determined, from conversion electron and photo-electron studies, as 1.03, 0.983, 0.103, 0.047, and 0.043 Mev. An energy level scheme for Pu^{238} is proposed.

5785 On the Self-energies of Quantum Field Theory. George Snow and Hartland S. Snyder. AECU-897, May 23, 1950. 8p.

It is shown that by means of a canonical transformation in quantum electrodynamics, the photon self-energy and the current associated with a mixture of zero-photon and one-photon states cannot be simultaneously made to vanish to order e^2. This difficulty can be overcome by adding a charged meson field. A general argument is given to show that the total self-energies of all particles must vanish. (auth)

5786 Effect of Tensor Range in Nuclear Two-Body Problems. Herman Feshbach, Julian Schwinger, and John A. Harr. HUX-5, Nov. 1949. 55p.

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The interaction between neutron and proton in the triplet state has been investigated. The central and tensor potentials have been assumed to be of the "meson" type but of possibly different ranges. The variational-iterational method has been utilized to determine V_0, the strength of the central potential, and γV_0, the strength of the tensor potential. A wide variation in the values of both central and tensor ranges were included. Calculations of this type have proved difficult in the past principally because of the sensitivity of the results to the quadrupole moment Q of the deuteron for which accurate wave functions are necessary. It would be desirable to have a more accurate value of Q deduced from experiment. The per cent D-state in the deuteron and the effective triplet range have also been computed. The results are applied to the discussion of the magnetic moment of the deuteron, the photoelectric disintegration of the deuteron, and neutron-proton scattering. It is concluded that experimental information on neutron-proton interaction at their present accuracy does not determine the range of the tensor forces except within rather broad limits. A decrease in the uncertainty in the triplet range by an order of magnitude would be required. Finally, it is concluded that charge independence of nuclear forces can be maintained with the meson well. 30 references. (auth)

5787 Effect of the Finite Size of the Nucleus on Internal Conversion. N. Tralli and M. E. Rose. ORNL-460, Sept. 28, 1949. 18p.

The internal conversion coefficients depend on (1) the scalar and vector potentials of the radiation field, (2) the initial bound-state wave functions of the electron, and (3) the continuum final-state wave functions. In this paper, the effect of the finite size of the nucleus on each of these is investigated separately. Results indicate the effect is negligibly small.

5788 Equivalence Theorems for Meson-Nucleon Couplings. Edward J. Kelly. Phys. Rev. 79, 399-400(1950) July 15 (Letter to the editor).

The author discusses the equivalence between pseudoscalar and pseudovector coupling between the meson and nuclear fields in pseudoscalar meson theory. He performs a rearrangement directly in the Lagrangian to eliminate the divergent terms immediately. His results agree with those of Case (Phys. Rev. 76, 14(1949)) to first order. The remaining terms are similar to his, differing only by a canonical change of representation. In the interaction representation, the vector coupling is represented by terms of no higher explicit order than the second, while in the representation used by Case, explicit terms of all orders presumably appear. In addition, the result in this article shows that scalar theories can be so formulated that contact terms never appear.

5789 Reflection Properties of Spin $\frac{1}{2}$ Fields and a Universal Fermi-Type Interaction. C. N. Yang and J. Tiomno. Phys. Rev. 79, 495-8(1950) Aug. 1.

The transformation property under an inversion of the space coordinates of the wave function of a particle of spin zero (or one) leads to the differentiation between scalar and pseudoscalar (or vector and pseudovector) particles. It is the purpose of the present note to point out that there is also

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a similar differentiation of the various spin ½ particles. In contrast to the case of integral spin, however, there are for spin ½ particles four different types of transformation properties under an inversion. The consequences are discussed, and the bearing on the possibility of a universal Fermi-type interaction is analyzed. (auth)

5790 Remarks on the Quasi-Atomic Model and Nuclear β Transitions. Robert Bouchez. Compt. rend. 231, 139-41(1950) July 10 (in French).

Nuclear β transitions using the quasi-atomic model have been studied. The author considers that a nuclide in a stationary state is formed by a small number of configurations characterized by (J,L), (J,L'), ---, L, L'---having the same parity in a nonrelativistic approximation. The model allows transitions to be interpreted in a reasonable way. (auth)

5791 Diffusion of Gold into Copper. A. B. Martin and Frank Asaro. NAA-SR-83, June 27, 1950. 29p.

The radioactive tracer method has been employed to measure the rate of diffusion of gold into copper. Experimental techniques are discussed in detail and a simple and inexpensive shielded chemical system is described which is suitable for remotely performing elementary chemical operations on radioactive samples measuring several hundred millicuries of beta and gamma activity. These experiments have yielded the values $Q = 44{,}900 \pm 1300$ cal/mole and $D_0 = 0.1 \pm 0.06$ cm^2/sec for the diffusion of gold into copper at low gold concentrations. In the course of the measurements, some attention was given to the variation in the rate of diffusion with (1) purity of copper, (2) grain size in the copper, and (3) concentration of gold. The results indicate that the variations in these parameters which were encountered in the course of the experiments have no significant effect on the measured diffusion rates. Additional experiments are planned, however, to investigate further an apparent dependence of the diffusion rate measured at a given temperature on the time of anneal. (auth)

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5792 The Electrolytic Production of Metallic Uranium. R. Rosen (to U. S. Atomic Energy Commission). U. S. Patent 2,519,792, Aug. 22, 1950.

This patent covers a process for producing metallic uranium by electrolyzing uranium tetrafluoride at an eleveated temperature in a fused bath consisting essentially of mixed alkali and alkaline earth halides.

5793 Manufacture of Oxygen-Containing Chlorinated Cyclic Compound. E. T. McBee and J. S. Newcomer (to U. S. Atomic Energy Commission). U. S. Patent 2,519,319, Aug. 15, 1950.

This patent discloses a method for making chloranil, or tetrachloroquinone, which comprises heating tetrachlorohydroxy-benzoic acid with SbF_5, hydrolyzing the reaction product to produce tetrachlorohydroquinone and oxidizing the tetrachlorohydroquinone to chloranil.

5794 Method of Disposing of Corrosive Gases. W. B. Burford, III, and H. C. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,515,112, July 11, 1950.

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Waste gas containing elemental fluorine is disposed of in the disclosed method by introducing the gas near the top of a vertical chamber under a downward spray of caustic soda solution which contains a small amount of sodium sulfide.

5795 Method of Dissolving Difficultly Soluble Metal Sulfates. A. H. Angerman (to U. S. Atomic Energy Commission). U. S. Patent 2,514,115, July 4, 1950.

In a process for dissolving difficultly soluble metal sulfates, such as the sulfates of lead, barium, strontium, and calcium, the same are dissolved by contacting with an aqueous solution containing dissolved nitrate of tetravalent zirconium.

5796 Phosphate Glass. Alexander Silverman, Joseph J. Rothermel, and Kuan-Han Sun. U. S. Patent 2,518,194, Aug. 8, 1950. (See also NSA 4-457.)

This patent describes the composition and properties of a phosphate glass to be used for shielding against x- and γ-radiation. In addition to phosphorus oxide, it contains at least one oxide of a hexavalent metal, such as molybdenum and tungsten, and at least one oxide of the group consisting of bismuth and lead. Some advantages of this glass are as follows: (1) It need only be 1.75 times as thick as lead to give equal protection. (2) It can be made colorless or in a variety of colors. (3) The color changes very slowly under intense x-ray bombardment. (4) It has a very high refractive index. (5) It can be made transparent or opaque in the visible and infrared region.

5797 Process for Fluorinating Hydrocarbons. A. F. Benning (to U. S. Atomic Energy Commission). U. S. Patent 2,521,626, Sept. 5, 1950.

A process is described for fluorinating a petroleum lubricating oil fraction boiling above 300°C by heating with a fluorinating agent such as cobalt trifluoride, silver difluoride or manganese trifluoride. The reaction mixture is cooled, trifluorotrichloroethane is added, solids are removed, and the remaining materials separated by distillation and fractionation.

5798 Precipitation Process and Apparatus Therefor. L. C. Stang, Jr. (to U. S. Atomic Energy Commission). U. S. Patent Application Serial No. 664,957, nd.

This invention concerns an apparatus for remotely-controlled precipitation and filtration operations. Liquid within a precipitation chamber is maintained above a porous member by introducing air beneath the member; pressure beneath the porous member is reduced to suck the liquid through the member and effect filtration.

5799 Purification of Hydrogen. A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent Application Serial No. 594,587, nd.

Disclosed is a process for purifying hydrogen containing various gaseous impurities by passing the hydrogen over a large surface of uranium metal at a temperature above the decomposition temperature of uranium hydride, and below the decomposition temperature of the compounds formed by the combination of the uranium with the impurities in the hydrogen.

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5800 Adjustable Centrifugal Switch. Q. J. Evans and A. Kushner (to U. S. Atomic Energy Commission). U. S. Patent 2,516,050, July 18, 1950.

This patent is concerned with an electrical switch which is responsive to the speed of rotation of a shaft to open and close a circuit at predetermined speeds of rotation.

5801 Apparatus for Testing Tensile Characteristics of a Material. C. K. Beck and D. Kirkpatrick (to U. S. Atomic Energy Commission). U. S. Patent 2,518,217, Aug. 8, 1950.

A tensile testing apparatus with provision for maintaining the test piece at a uniform predetermined temperature while it is being stressed is disclosed.

5802 Hydraulically Driven Oscillatory Brush. J. D. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,514,142, July 4, 1950.

A power operated brush for cleaning or scrubbing surfaces is described. A housing around the brush which can be held in fluidtight contact with the surface being cleaned has a connection which makes it possible to withdraw the cleaning fluid and air from within the housing.

5803 Induction Reamer. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,514,116, July 4, 1950.

An apparatus for operating on the interior of a cylindrical tube is disclosed and claimed in this patent. An unattached circular tool carrying a squirrel cage winding is rotated inside the cylindrical tube by means of a rotating magnetic field generated through the squirrel cage winding.

5804 Method of Measuring Corrosion and Erosion. W. B. Shank, E. C. Creutz, and D. H. Gurinsky (to U. S. Atomic Energy Commission). U. S. Patent 2,519,323, Aug. 15, 1950.

This patent covers a method for measuring the eroding and corroding effect of a fluid on a solid material which comprises rotating a hollow cylindrical body of the solid material in a quantity of the fluid with only the outer walls of the cylinder exposed to the fluid, and weighing the solid material before and after exposure to the fluid.

5805 Quick Operating Valve. E. Zurcher (to U. S. Atomic Energy Commission). U. S. Patent 2,515,159, July 11, 1950.

A mechanism whereby a large valve can be quickly operated between an open and closed position is described. The valve actuator consists of a crank and pitman which form a toggle joint with one of the toggle members resiliently mounted so that the resiliency permits the toggle joint to move over center after the valve seats.

5806 Carbonaceous Articles and Production Thereof. H. A. Wilhelm and P. S. Gerald (to U. S. Atomic Energy Commission). U. S. Patent 2,521,495, Sept. 5, 1950.

A carbonaceous article is produced by shaping a carbonaceous mixture which is coherent and plastic at or about room temperature comprising carbon in a pulverulent state, a solid fusible coking binder such as powdered pitch or coal tar resin or shellac which is adhesive at an elevated temperature and a further carbonaceous gum binder which is adhesive at or about room temperature, and coking the resulting product.

5807 Acoustic Chamber for Analysis of Gaseous Mixture. W. H. Janssen and W. Mikelson (to U. S. Atomic Energy Commission). U. S. Patent 2,521,634, Sept. 5, 1950.

This patent covers an acoustic chamber in which the effective molecular weight of a gaseous mixture may be determined by measuring the natural frequency of the chamber while filled with the gas. Construction details of the chamber minimize possible corrosive influences of the gas.

5808 Detecting Device. W. R. Kanne (to U. S. Atomic Energy Commission). U. S. Patent 2,513,805, July 4, 1950.

An inexpensive fluorescent instrument for detecting radioactivity by contrasting visual effects is described in this patent. The device contains a plurality of fluorescent screens facing in different directions with absorbers positioned in such a manner that in the presence of radioactive substances the fluorescent effect is clearly indicated by the contrast between the fluorescing portion of the instrument and the nonfluorescing portion covered by the absorbers.

5809 Dispersion Separation. M. Kilpatrick (to U. S. Atomic Energy Commission). U. S. Patent 2,521,121, Sept. 5, 1950.

A method and apparatus for separating the phases of a liquid dispersion is disclosed. The dispersion is forced, while being agitated, against a porous member with sufficient pressure to force at least one of the phases of the dispersion through the porous member.

5810 Ionization Chamber. E. G. Segre and O. Chamberlain (to U. S. Atomic Energy Commission). U. S. Patent 2,521,656, Sept. 5, 1950.

This patent is concerned with an improved ion chamber wherein hydrogenous material performs the dual function of insulatingly supporting the various metal portions of the chamber while substantially filling the interior portion of the chamber to provide improved scattering, diffusing, and slowing of fast neutrons to thermal energies.

5811 Method and Apparatus for Measuring Alpha Particle Radiation. R. W. Dodson and W. H. Beamer (to U. S. Atomic Energy Commission). U. S. Patent 2,517,469, Aug. 1, 1950.

This patent describes a method and apparatus for detecting and measuring α particle emission, particularly that from high intensity α-particle sources. The α particle radiation which it is desired to detect and measure is converted by induced (α-n) nuclear reactions into neutron particle radiation, thereby making possible the use of neutron detection and measuring means for providing an indication of the α-particle activity of the source under test.

5812 Method and Apparatus for Separating Fluids by Thermal Diffusion. J. W. Beams (to U. S. Atomic Energy Commission). U. S. Patent 2,521,112, Sept. 5, 1950.

This patent covers a method and apparatus for separating fluid mixtures by thermal diffusion. Two thermally conducting

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parallel tapes are moved in opposite directions to conduct lighter and heavier components counter current to each other. The separation fractions produced are drawn off at the end of their respective courses.

5813 Pulse-Forming Preamplifier. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,517,676, Aug. 8, 1950.

This patent discloses a method and apparatus for the control of a frequency modulated system by utilizing a combination of several circuits to transform a frequency modulated signal voltage into a rectangular voltage pulse of variable duration occurring at a predetermined rate in response to a selected frequency within the frequency range of the frequency modulated signal voltage.

5814 Radiation Counters. V. C. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,519,007, Aug. 15, 1950.

An improved radiation counter primarily useful in detecting and measuring fast neutrons is described. The instrument is constructed with a plurality of hydrogenous wafers which divide the space between the counter electrodes into a number of ionization regions.

5815 Radiation Detector. H. G. Neil (to U. S. Atomic Energy Commission). U. S. Patent 2,514,135, July 4, 1950.

This invention concerns a system responsive to radiation which produces an audible note distinguishing the intensity and frequency of the radiation.

5816 Secondary Electron Multipliers. A. H. Snell and L. C. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,521,133, Sept. 5, 1950.

PATENTS

A secondary electron multiplier system for radiation detection, which is capable of discriminating between incident radiations, and which produces an output signal having its magnitude distribution substantially proportional to the number of incident quanta of a particular radiation is covered in this patent.

5817 Voltage Supply Circuit for Vacuum Tubes. D. K. Froman (to U. S. Atomic Energy Commission). U. S. Patent 2,517,863, Aug. 8, 1950.

This invention is concerned with a vacuum tube circuit for supplying operating potentials to various electrodes of vacuum tubes under conditions which demand that certain of these potentials be maintained constant and that no undesired reactance be introduced by the source supplying these potentials.

5818 Coincidence Proportional Counter. J. H. Manley (to U. S. Atomic Energy Commission). U. S. Patent Application Serial No. 634,861, nd.

A coincidence proportional counter having a plurality of collecting electrodes so disposed as to measure the range or energy spectrum of an ionizing particle-emitting source such as an alpha source, is disclosed.

5819 Detection Apparatus. H. L. Anderson (to U. S. Atomic Energy Commission). U. S. Patent Application Serial No. 634,862, nd.

This invention concerns a sensitive apparatus for detecting and counting neutrons, particularly neutrons liberated in an alpha, neutron reaction. The apparatus includes an improved ionization chamber structure together with an improved combination alpha-particle source and holder for the material under test.

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